First Hit Previous Doc Next Doc Go to Doc#

Generate Collection Print

y+

L9: Entry 2 of 3 File: PGPB Feb 14, 2002

PGPUB-DOCUMENT-NUMBER: 20020017989
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020017989 A1

TITLE: Deactivation of field-emitting electronic device upon detection of a transportation vessel

PUBLICATION-DATE: February 14, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Forster, Ian J.	Essex	GA	GB	
Horrell, Peter Robert George	Essex		GB	
Puleston, David J.	Duluth		US	

APPL-NO: 09/ 898498 [PALM]
DATE FILED: July 3, 2001

RELATED-US-APPL-DATA:
Application 09/898498 is a continuation-in-part-of US application 09/542772, filed April 4, 2000, US Patent No. 6281797

INT-CL: [07] G08 B 21/00

US-CL-PUBLISHED: 340/540; 340/573.1, 340/945
US-CL-CURRENT: 340/540; ~~340/573.1~~, ~~340/945~~
870.~~31~~, ~~93~~

REPRESENTATIVE-FIGURES: 1

825.36
7.24, 7.25

ABSTRACT:

An electronic device that includes a field-emitting device that emits electric, magnetic and/or electromagnetic signals. The electronic device is associated with includes one or more sensors that are capable of detecting the proximity of a transportation vessel. Upon detection of the proximity of a transportation vessel, the electronic device deactivates and/or decouples power to the field-emitting device and/or other systems of the electronic device so that the components of the electronic device can no longer emit signals that may interfere with the transportation vessel systems. The electronic device may reactivate and/or re-couple power to the field-emitting device if the sensor(s) no longer detects the proximity of a transportation vessel. The electronic device may also perform the reactivation and deactivation procedure if the electronic device detects a hazardous area.

RELATED APPLICATION

[0001] This application is a continuation-in-part application of pending patent application Ser. No. 09/542,772, entitled "Method and apparatus for detecting a container proximate to a transportation vessel hold," filed on Apr. 4, 2000.

Previous Doc Next Doc Go to Doc#

First Hit Previous Doc Next Doc Go to Doc#

Generate Collection Print

L9: Entry 2 of 3 File: PGPB Feb 14, 2002

DOCUMENT-IDENTIFIER: US 20020017989 A1
TITLE: Deactivation of field-emitting electronic device upon detection of a transportation vessel

Abstract Paragraph:
An electronic device that includes a field-emitting device that emits electric, magnetic and/or electromagnetic signals. The electronic device is associated with includes one or more sensors that are capable of detecting the proximity of a transportation vessel. Upon detection of the proximity of a transportation vessel, the electronic device deactivates and/or decouples power to the field-emitting device and/or other systems of the electronic device so that the components of the electronic device can no longer emit signals that may interfere with the transportation vessel systems. The electronic device may reactivate and/or re-couple power to the field-emitting device if the sensor(s) no longer detects the proximity of a transportation vessel. The electronic device may also perform the reactivation and deactivation procedure if the electronic device detects a hazardous area.

Summary of Invention Paragraph:
[0009] There are many different types of sensors and methods that the electronic device can use to sense the proximity of a transportation vessel. One or more of these sensors may be associated with the electronic device. If more than one sensor is associated with the electronic device, the electronic device may be capable of detecting the proximity of a transportation vessel using the sensors either individually or in conjunction with each other. These sensors may also be used to determine when the electronic device is no longer in proximity to a transportation vessel so that the field-emitting device can be reactivated or re-coupled to power.

Summary of Invention Paragraph:
[0021] In another cooperative marker sensor embodiment, the electronic device uses an ultrasonic marker sensor to detect ultrasonic marker signals signifying the proximity of a transportation vessel. Ultrasonic markers that emit specific ultrasonic signals are placed in proximity to the transportation vessel.

Summary of Invention Paragraph:
[0022] In another cooperative marker sensor embodiment, the electronic device uses an infrared beacon sensor to detect infrared signals from an infrared marker placed in proximity to the transportation vessel. The electronic device detects the proximity of a transportation vessel when the electronic device detects an infrared signal emitted by the infrared marker.

Summary of Invention Paragraph:
[0023] In another cooperative marker sensor embodiment, the electronic device uses a frequency beacon detector to detect frequency signals from a frequency beacon marker located in proximity to a transportation vessel. The frequency beacon detector may be the same detector as the frequency detector if the frequency signals emitted by the frequency beacon marker and the transportation vessel are of substantially the same frequency.

Brief Description of Drawings Paragraph:
[0037] FIG. 11 is a schematic diagram of an imaging emitter and detector;

Detail Description Paragraph:
[0046] The electronic device 100 includes a field-emitting device 101. The field-emitting device 101 comprises electronics or other circuitry that emits electric, magnetic and/or electromagnetic signals. The field-emitting device 101 may emit a field by design to carry out an intended function. For example, the field-emitting device 101 may be communication electronics and an antenna (not shown) that communicates information to and from a cellular phone electronic device 100. Alternatively, the field-emitting device 101 may emit a field as a byproduct of a function. For example, the field-emitting device 101 may be a computer display that emits a field when a cathode ray tube directs electrons to a screen to display information. Regardless of purpose and intent, the field-emitting device 101 encompasses any electric, magnetic, and/or electro-magnetic signals emitted by the electronic device 100.

Detail Description Paragraph:
[0047] The field emitted by a field-emitting device 101 may interfere with systems on a transportation vessel during its operation, potentially creating a dangerous condition. For example, aircraft include communication systems for communication to a tower for air traffic control and for navigational purposes. If a field-emitting device 101 emits a field interferes with the aircraft communication systems, the aircraft communication systems may not operate properly, thereby jeopardizing the aircraft's communication of information critical to the aircraft's safe operation.

Detail Description Paragraph:
[0057] By way of example, FIGS. 4A, 4B and 4C illustrate other types of electronic devices 100 that contain a field-emitting device 101 and which may be used with the present invention. FIG. 4A is an illustration of a typical cellular phone. A cellular phone 100A contains a field-emitting device 101A in the form of communication electronics that communicates data in the form of radio-frequency signals. FIG. 4B is an illustration of a typical personal digital assistant 100B that includes a field-emitting device 101B in the form of a radio-frequency transmitter/receiver. FIG. 4C is an illustration of a typical laptop computer 100C that includes a field-emitting device 101C in the form of a monitor display . All of the aforementioned electronic devices 100A, 100B, 100C contain field-emitting devices 101A, 101B, 101C that may be used with the present invention and include a control system 102 similar to that illustrated in FIG. 1 to deactivate their respective field-emitting devices 101A, 101B, 101C and/or other systems upon detection of the proximity of a transportation vessel 50, such as aircraft transportation vessel 50.

Detail Description Paragraph:
[0064] FIG. 7 describes the deactivation/reactivation procedure of the field-emitting device 101 (step 308) illustrated in FIG. 6 for an embodiment where the electronic device 100 includes a tracking device 118A. The deactivation process begins (step 330), the control system 102 directs the power system 110 to decouple power from the field-emitting device 101 (step 332). The control system 102 then determines if the field-emitting device 101 has been disabled due to lack of reception of positioning information signals from the tracking device 118A (discussed below) (decision 333). If yes, the control system 102 reads memory 104 to determine if any additional systems in the electronic device 100 should be disabled (decision 335), and such disabling is carried out if programmed (step 337). The control system 102 then continually checks to see if positioning information has been received by the tracking device 118A until positioning information signals are received (decision 339). The electronic device 100 is able to perform this function since the deactivation process may not deactivate the reception of the tracking device 118A. When positioning information is received successfully again by the tracking device 118A, the electronic device 100 is

reactivated and resumes the transmission of positioning information concerning the location of the electronic device 100 to the remote site 130 (step 308 in FIG. 5).

Detail Description Paragraph:
[0074] When the electronic device 100 coupled to the tracking device 118A is placed into the transportation vessel 50, the satellite signals may be blocked by the transportation vessel 50 and may not reach the tracking device 118A. The tracking device 118A communicates to the control system 102 that the signals are not being received, which the control system 102 via the input/output device 106 equates to the electronic device 100 being in proximity to or being placed into the transportation vessel 50. As the electronic device 100 is being loaded into the transportation vessel 50 as illustrated in FIG. 3, the tracking device 118A may receive only a limited number of signals or positioning information from the satellites 201. The "one-sided" signal reception is a result of some of the satellite positioning information being blocked by the transportation vessel 50, while others still reach the tracking device 118A. Therefore, the control system 102 may identify the electronic device 100 as being in proximity to or being placed into the transportation vessel 50 if only one or two satellite signals are received by the tracking device 118A. The "one-sided" signal reception may be the primary indication for the control system 102 to deactivate the field-emitting device 102, or it may be a redundant check also requiring a full loss of signals prior to deactivation.

Detail Description Paragraph:
[0080] The electronic device 100 is capable of detecting the proximity of a transportation vessel 50 using a frequency detector 118C, as illustrated in FIG. 9, if the transportation vessel 50 emits frequency signals during its normal operation that are detectable by the frequency detector 118C. An aircraft transportation vessel 50 with jet engines, for example, may produce specific frequencies during operations, such as take off, landing, taxiing, and preflight checks. Detection of the electronic device 100 in the aircraft transportation vessel 50 may be accomplished by detecting specific emitted frequencies that are unique to the aircraft transportation vessel 50.

Detail Description Paragraph:
[0081] FIG. 9 illustrates a frequency detector 118C according to one preferred embodiment for detecting a signal in the range of 400 Hz. Aircraft power systems use an AC 400 Hz power distribution system that is somewhat unique to an aircraft 50 engine, as described in U.S. Pat. No. 5,835,322, entitled "Ground fault interrupt circuit apparatus for 400-Hz aircraft electrical systems," incorporated herein by reference in its entirety. A frequency detector 118C that detects a signal at approximately 400 Hz may indicate that the transportation vessel is power and/or that the electronic device 100 is in proximity to the aircraft transportation vessel 50 and that the field-emitting device 101 should be deactivated in accordance with the deactivation process.

Detail Description Paragraph:
[0085] A spectrum analyzer may be used as a frequency detector 118C to determine the presence of a particular frequency signal in a manner such as that described in U.S. Pat. No. 3,418,574, incorporated herein by reference in its entirety. The spectrum analyzer scans a band of signal frequencies in order to determine the frequency spectrum of any signal emitted by the aircraft transportation vessel 50. There are other methods of detecting particular frequency signals so as to provide a frequency detector 118C, and the preferred embodiments are not intended to limit the present invention from using such other methods.

Detail Description Paragraph:
[0086] It is also noted that other frequency signals may be emitted when the electronic device 100 is in proximity to an aircraft transportation vessel 50, such as at an aircraft field. Aircraft towers or other communication devices may emit FM

signals that can be detected by the frequency detector 118C to indicate that the electronic device 100 is either in an aircraft transportation vessel 50 or proximate to an aircraft transportation vessel 50 such that the deactivation process should be performed. Therefore, the present invention is not limited to detection of any specific frequency signals and the signals do not necessarily have to be emitted from the transportation vessel 50 itself.

Detail Description Paragraph:
[0095] The electronic device 100 can detect the proximity of a transportation vessel 50 by using a capacitance sensor 118F to detect a change in capacitance. For example, when the electronic device 100 is placed into an aircraft transportation vessel 50, the electronic device 100 may be associated with a container 10 that is placed into the cargo hold. The container 10 may be constructed to conform to the dimensions of the cargo hold to reduce or eliminate any non-usable space. As such, the containers 10 are often placed in proximity to or against the inner walls of the cargo hold. The body of the transportation vessel 50 may be made out of special materials with defined thicknesses and other characteristics that affect the capacitance of the container 10 when placed in close proximity thereto. The electronic device 100 may include a capacitance sensor 118F to sense the capacitance of the container 10. One such sensor is described in U.S. Pat. No. 4,219,740, entitled "Proximity sensing system and inductance measuring technique," incorporated herein by reference in its entirety, that describes using a variable inductance/capacitance measuring device to monitor the proximity of a target object.

Detail Description Paragraph:
[0098] The electronic device 100 can also detect the proximity of a transportation vessel 50 by detecting the curvature of its cargo hold. For example, aircraft 50 cargo holds have distinctive shapes due to the curvature of the body of the aircraft 50. An imaging sensor or light sensor 118G may emit a spectrum of light during the shipment of the electronic device 100 and read the reflection to determine if the electronic device 100 has been placed in an area containing a curvature like that of the cargo hold.

Detail Description Paragraph:
[0099] FIG. 11 illustrates one example of an imaging sensor 118G which comprises an imaging emitter 506 and detector 509. The imaging sensor 118G uses an imaging emitter 506 to scan the area of interest with a beam 500. The scanning is achieved by moving a mirror, such as a reflector 502 that is rotated about a rotational axis 504. The light source emitted by the imaging emitter 506 may be a laser or laser diode. An optical lens 508 converts the light into a beam 500. The beam 500 scans the aircraft surface 501 and the reflected light passes through an imaging detector 509 that is comprised of an optical lens 510 that produces an image of the scanned area on photo detectors 512, which generate electrical signals representing the surface 501. A detecting system 514 then determines the pattern or width of the electrical signals to translate such signals to information.

Detail Description Paragraph:
[0100] The imaging emitter 506 continues to emit a spectrum of signals, such as infrared signals, from the electronic device 100 during shipment. The imaging detector 509 receives the reflection of the light emitted by the imaging emitter 506. Bends or curves in a reflected surface bend or curve the light received from by the imaging detector 509. The control system 102, via the input/output interface 106, continually monitors the reading from the imaging detector 509 and compares it to a predefined reading stored in memory 104. If the image received by the imaging detector 509 indicates that the electronic device 100 is in proximity to the transportation vessel 50 cargo hold, the control system 102 carries out the deactivation and reactivation process as described above in FIG. 7.

Detail Description Paragraph:

[0103] The cooperative marker sensors 120 may be active devices that pick up signals from emitters placed purposely in proximity to the transportation vessel 50 and/or its cargo hold. Alternatively, the cooperative marker sensors 120 may be passive devices that differ from active devices in that emitters are not placed in or proximate to the transportation vessel 50 or its cargo hold. Instead, for passive devices, cooperative markers 60 are placed in or proximate top the transportation vessel 50 or its cargo hold that are not active devices, such as emitters, but simply represent codes or markings that are detected by passive cooperative marker sensors 120 to relay information.

Detail Description Paragraph:
[0104] Cooperative marker sensors 120 may include an optical marker sensor 120A, a capacitance marker sensor 120B, an ultrasonic marker sensor 120C, an infrared beacon sensor 120D, a frequency beacon detector 120E, and/or a magnetic marker sensor 120F. Each of the cooperative markers 60 sensed are used for executing step 304 in FIG. 6, the logic of which has been previously discussed above.

Detail Description Paragraph:
[0108] Similar to that illustrated in FIG. 11 above, the optical marker sensor 120A emits spectrum signals such as an infrared signal or laser signal from the electronic device 100 during shipment. The optical marker sensor 120A receives the reflection of the light emitted to determine if the optical marker sensor 120a is picking up information from the relevant cooperative marker 60, such as a Snowflake.RTM. code 520. When information is detected by the optical marker sensor 120A from the Snowflake code 520, the optical marker sensor 120A passes such information to the control system 102 through the input/output interface 106. The control system 102 determines whether the information read from the Snowflake code 520 indicates that the electronic device 100 is in proximity to the transportation vessel 50, in which case the control system 102 carries out the deactivation and reactivation process, as described above in FIG. 7.

Detail Description Paragraph:
[0113] In one embodiment, pipes 604 with specific resonant frequencies are placed in proximity to or within the transportation vessel 50. The control system 102, via the input/output interface 106, causes the ultrasonic emitter 600 to transmit frequencies across a band in which resonant frequencies are expected to occur. The control system 102 receives response frequencies from the ultrasonic transponder 602 in response to signals emitted by the ultrasonic emitter 600 and compares them in memory 104 to signals expected to be received when the electronic device 100 is in proximity to the transportation vessel 50 with pipes 604. If the control system 102 receives signals from the ultrasonic transponder 602 that are expected when the electronic device 100 is in proximity to the transportation vessel 50, this indicates that the electronic device 100 is in proximity to the transportation vessel 50, in which case the control system 102 carries out the deactivation and reactivation process. Although the reactivation procedure for this method (i.e., the detection of when the electronic device 100 is no longer in proximity to the transportation vessel 50) requires transmission of an ultrasonic or sonic acoustic, these signals are considered similar to the acoustic emissions from parts of the transportation vessel 50, such as from pumps, motors and engines, and therefore will not effect the transportation vessel 50 systems. Transportation vessels 50 are designed to operate properly in the presence of vibration or noise.

Detail Description Paragraph:
[0114] Alternatively, the control system 102 may cause the ultrasonic emitter 600 to transmit bursts of acoustic noise covering the desired band of frequencies. When the transmitted signals are stopped, the pipes 604 will continue to resonate at their resonant frequency and the control system 102 will be able to continue to receive their response signals through the ultrasonic transponder 602.

Detail Description Paragraph:

[0115] Additional ultrasonic marker sensors 120C and sensing systems, such as that described in U.S. Pat. No.4,779,240, entitled "Ultrasonic sensor system," incorporated herein by reference in its entirety, can be used to sense the frequency response of emitted signals to markers placed purposely in proximity to a transportation vessel 50, and the present invention is not limited to any particular type of ultrasonic marker sensor 120C or sensing system.

Detail Description Paragraph:
[0116] Infrared Beacon Sensor

Detail Description Paragraph:
[0117] The infrared beacon sensor 120D is an active sensor that senses the presence of a cooperative marker 60 that emits a specific beacon of light like that described in U.S. Pat. No. 5,165,064, entitled "Mobile robot guidance and navigation system," incorporated herein by reference in its entirety. The electronic device 100 is associated with an infrared beacon sensor 120D that detects infrared signals emitted by an infrared beacon marker placed in the transportation vessel 50.

Detail Description Paragraph:
[0118] The cooperative infrared beacon marker 60 placed in the transportation vessel 50 emits a light in the cargo hold area. The infrared beacon sensor 120D detects light emitted in its path and transmits signals to the control system 102 of the electronic device 100 through the input/output interface 106. If the control system 102 receives signals from the infrared beacon sensor 120D associated with the detection of light from a cooperative infrared beacon marker 60 placed in proximity to a transportation vessel 50, this indicates that the electronic device 100 is proximate to a transportation vessel 50, in which case the control system 102 carries out the deactivation and reactivation procedure as previously described in FIG. 7.

Detail Description Paragraph:
[0119] Frequency Beacon Detector

Detail Description Paragraph:
[0120] The electronic device 100 may determine if the electronic device 100 is in proximity to a transportation vessel 50 by using a frequency beacon detector 120E that detects frequencies emitted by a frequency beacon (not shown) in proximity to the transportation vessel 50. The frequency beacon detector 120E may be the same as that described for the frequency detector 118C. In one embodiment, the frequency beacon emits a signal frequency of 400 Hz, which is the same frequency emitted by the aircraft transportation vessel 50 AC power distribution systems. In this manner, a redundancy is built into the system automatically. The frequency beacon detector 120E will detect 400 Hz signals whether they are from the frequency beacon or from the transportation vessel 50 AC power distribution system, as described previously, thereby adding an extra measure of reliability and accuracy. However, it should be noted that a frequency beacon may be used that does not emit frequencies that are the same as those emitted naturally by a transportation vessel 50 and/or its systems as the sole method of determining whether or not an electronic device 100 is in proximity to a transportation vessel 50.

Detail Description Paragraph:
[0121] A frequency beacon detector 118E that detects 400 Hz signals could indicate that the electronic device 100 is in proximity to the transportation vessel 50 so that the electronic device 100 can perform the deactivation procedure. Three receiving elements 440, as previously illustrated in FIG. 9, that are orthogonal to each other in three dimensions may be used as the frequency beacon detector 120E for detecting the desired frequency signals. The receiving elements 440 may be tuned circuits to detect the desired frequency, or magnetometers designed to sensitively measure AC field strengths, both of which are well known and

commonplace.

Detail Description Paragraph:
[0122] The control system 102 of the electronic device 100 receives signals from the frequency beacon detector 120E via the input/output interface 106. If the control system 102 reads a signal from the frequency beacon detector 120E that is known to be the frequency of the frequency beacon, the microprocessor 103 of the control system 102 will know that the electronic device 100 is in the transportation vessel 50 and will initiate the deactivation/reactivation procedure as previously described in FIG. 7.

Detail Description Paragraph:
[0126] When more than one sensor 118, 120 is coupled to the electronic device 100 for detection of the proximity of the transportation vessel 50, the control system 102 may determine deactivation upon receiving signals from one or more sensors 118, 120. In a configuration in which the control system 102 deactivates upon receiving only one signal, the sensors 118, 120 work as redundant systems to reduce the likelihood that the electronic device 100 could be placed on the transportation vessel 50 without deactivation. A redundant system allows for one of the sensors to be miscalibrated or damaged without impacting the deactivation process. Conversely, when the control system 102 requires more than one signal, the field-emitting device 101 is not deactivated by a sensor transmitting false proximity readings.

Detail Description Paragraph:
[0131] Additionally, the electronic device 100 may use cooperative marker sensors 120, described above, to detect when it is in or proximate to an intrinsically safe area. Cooperative markers 120 such as the optical marker sensor 120A, the ultrasonic marker sensor 120C, the infrared beacon sensor 120D, the frequency beacon detector 120E, and the magnetic marker sensor 120F all may be used individually or in combination to provide such functionality.

CLAIMS:

6. The device of claim 5, wherein said control system deactivates said field-emitting device if said pressure signals exerted on said electronic device exceeds a threshold value.

16. The device of claim 15, wherein said control system deactivates said field-emitting device if the frequency signals indicate that the transportation vessel is powered.

18. The device of claim 17, wherein said control system deactivates said field-emitting device if signals from said motion sensor indicate that the electronic device is in proximity to the transportation vessel.

21. The device of claim 19, wherein said cooperative marker sensor comprises an infrared beacon sensor and said marker information comprises an infrared signal.

22. The device of claim 19, wherein said cooperative marker sensor comprises a frequency beacon detector and said marker information comprises a frequency signal.

23. The device of claim 22, wherein said frequency beacon detector detects frequency signals independent of orientation.

24. The device of claim 22, wherein said frequency beacon detector is adapted to detect frequency signals of substantially the same frequency as naturally emitted by the transportation vessel.

33. A method of deactivating a field-emitting device upon detection of the

proximity of a transportation vessel, comprising the steps of: sensing the proximity of the transportation vessel; and deactivating a field-emitting device in response to the sensing of the proximity of the transportation vessel.

35. The method of claim 33, wherein said sensing comprises detecting a frequency signal emitted by the transportation vessel.

40. The method of claim 33, wherein said sensing comprises detecting a frequency signal emitted by a frequency beacon associated with the transportation vessel.

43. The method of claim 33, wherein said sensing comprises detecting an infrared signal emitted by an infrared beacon associated with the transportation vessel.

Previous Doc Next Doc Go to Doc#

L14: Entry 11 of 12 File: USPT May 30, 1989

US-PAT-NO: 4834531
DOCUMENT-IDENTIFIER: US 4834531 A

TITLE: Dead reckoning optoelectronic intelligent docking system

DATE-ISSUED: May 30, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Ward; Steven M.	Las Cruces	NM		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Energy Optics, Incorporated	Las Cruces	NM			02

APPL-NO: 06/ 793292 [PALM]
DATE FILED: October 31, 1985

INT-CL: [04] G01C 3/08, B64G 1/62, H04N 7/18

US-CL-ISSUED: 356/5; 244/161, 358/107
US-CL-CURRENT: 356/5.08; 244/161, 348/140, 356/139.03

FIELD-OF-SEARCH: 356/1, 356/4, 356/5, 356/152, 244/161, 244/164, 244/171, 358/100, 358/103, 358/107, 358/108, 358/125

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3224709	December 1965	Blizard	244/161
3285533	November 1966	Jernigan, Jr.	244/161
3666367	May 1972	Farnsworth et al.	356/5
3781111	December 1973	Fletcher et al.	356/5
3796492	March 1974	Cullen et al.	356/1 X
3897150	July 1975	Bridges et al.	356/5
3917196	November 1975	Pond et al.	342/23
4003659	January 1977	Conard et al.	356/152

☐	4026654	May 1977	Beaurain	356/5
☐	4167329	September 1979	Jelalian et al.	356/5
☐	4219847	August 1980	Pinkney et al.	358/105 X
☐	4260187	April 1981	Bejczy et al.	244/161 X
☐	4291977	September 1981	Erdmann et al.	356/152
☐	4295740	October 1981	Sturges, Jr.	244/161 X
☐	4297725	October 1981	Shimizu et al.	358/125
☐	4373804	February 1983	Pryor et al.	356/4 X
☐	4582424	April 1986	Kawabata	356/1
☐	4620788	November 1986	Giger	356/5

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0122890	October 1984	EP	
2186658	January 1974	FR	
2433760	March 1980	FR	

ART-UNIT: 222

PRIMARY-EXAMINER: Buczinski; Stephen C.

ASSISTANT-EXAMINER: Wallace; Linda J.

ATTY-AGENT-FIRM: Hogan; Patrick M.

ABSTRACT:

An intelligent, optoelectronic docking system for use in manned or unmanned spacecraft for automatically docking with a target spacecraft. The system is a multifaceted, active sensor using a controlling microprocessor to integrate the operation of independently triggerable laser sources for target illumination and optical receiver arrays for target detection. Returning signal waveforms are processed to sense the direction, range, and attitude of a target docking surface which may be equipped with passive optical aids to enhance the reflective signature. The docking system reconfigures its active sensor elements as the target range closes by sequentially employing three laser transceiver arrangements. As a result, the system effectively tracks a target from a range of several hundred meters down to a range of only a few centimeters. The system microprocessor operates on data received from each sensor arrangement to generate the information necessary to guide a host spacecraft safely through hard docking maneuvers. Wide field coverage is achieved without moving parts by electronic selection of independently directed laser beams.

23 Claims, 9 Drawing figures

Previous Doc Next Doc Go to Doc#

Case Creation Option

Case "10635869" already exists. Please overwrite it or cancel the operation.

The Contents of Case *"10635869"*

Qnum	Query	DB Name	Thesaurus	Operator	Pl
Q1	(audio adj beacon) same (ship or aircraft or airplane)	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	ASSIGNEE	OR	Y
Q2	virtual$ near3 beacon$	PGPB,USPT,USOC	ASSIGNEE	OR	Y
Q3	Q2 and (ship or aircraft or airplane)	PGPB,USPT,USOC	ASSIGNEE	OR	Y
Q4	Q3 and (audio with beacon$)	PGPB,USPT,USOC	ASSIGNEE	OR	Y
Q5	Q3 and (audio$ with beacon$)	PGPB,USPT,USOC	ASSIGNEE	OR	Y
Q6	Q2 and (ship or aircraft or airplane) and audio$	PGPB,USPT,USOC	ASSIGNEE	OR	Y
Q7	virtual$ with beacon$	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	ASSIGNEE	OR	Y
Q8	Q7 and path$ and guid$	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	ASSIGNEE	OR	Y
Q9	Q8 and (audio$ with beacon$)	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	ASSIGNEE	OR	Y
Q10	Q9 and gps	PGPB,USPT	ASSIGNEE	OR	Y
Q11	Q1 or Q7 or Q2	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	ASSIGNEE	OR	Y
Q12	Q11 and (audio$ with	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	ASSIGNEE	OR	Y

	beacon$)				
Q13	('6275164'| '20040030491'| '2107155') [URPN]	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	ASSIGNEE	OR	Y
Q14	('6275164'| '20040030491'| '2107155') [PN]	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	ASSIGNEE	OR	Y
Q15	(5389935 | 5742666 | 5555286 | 3176229 | 5367306 | 4888595 | 6052052 | 5974031 | 5024447 | 4394777 | 5914675 | 4630289 | 5515061 | 5563612 | 5731785 | 5157405 | 5515419 | 5742233 | 3613085 | 3790948 | 5726663)! [PN]	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	ASSIGNEE	OR	Y
Q16	Q15 or Q13	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	ASSIGNEE	OR	Y
Q17	Q16 and (audio$ with beacon$)	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	ASSIGNEE	OR	Y
Q18	Q16 and (audio$ same beacon$)	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	ASSIGNEE	OR	Y
Q19	Q18 and ((virtual$ or imagin$) same beacon$)	PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD	ASSIGNEE	OR	Y

L20: Entry 4 of 5 File: PGPB Jun 26, 2003

PGPUB-DOCUMENT-NUMBER: 20030120389
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030120389 A1

TITLE: Robotic vacuum cleaner

PUBLICATION-DATE: June 26, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Abramson, Shai	Pardesia		IL	
Levin, Shalom	Atlit		IL	
Zaslavsky, Ran	Kfar Saba		IL	

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	COUNTRY	TYPE CODE
F Robotics Acquisitions Ltd.				03

APPL-NO: 10/ 360092 [PALM]
DATE FILED: February 7, 2003

RELATED-US-APPL-DATA:
Application 10/360092 is a continuation-of US application 10/007103, filed December 4, 2001, PENDING

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	DOC-ID	APPL-DATE
IL	145680	2001IL-145680	September 26, 2001

INT-CL: [07] G06 F 19/00

US-CL-PUBLISHED: 700/245; 318/568.12
US-CL-CURRENT: 700/245; 318/568.12

REPRESENTATIVE-FIGURES: 1

ABSTRACT:

An autonomous robot, that is for example, suitable for operations such as vacuuming and surface cleaning includes a payload configured for vacuum cleaning, a drive system including a steering system, a navigation system, and a control system for integrating operations of the aforementioned systems.

L20: Entry 4 of 5 File: PGPB Jun 26, 2003

DOCUMENT-IDENTIFIER: US 20030120389 A1
TITLE: Robotic vacuum cleaner

Abstract Paragraph:
An autonomous robot, that is for example, suitable for operations such as vacuuming and surface cleaning includes a payload configured for vacuum cleaning, a drive system including a steering system, a navigation system, and a control system for integrating operations of the aforementioned systems.

Summary of Invention Paragraph:
[0008] An embodiment of the invention includes an apparatus for autonomous vacuum cleaning comprising, a payload configured for vacuum cleaning, a drive system including a steering system, a navigation system, and a control system. The control system includes a processor, e.g., a microprocessor, that is configured for integrating operations of the payload, drive system and navigation system.

Summary of Invention Paragraph:
[0010] Another embodiment is directed to an apparatus for autonomous operation over an area comprising a drive system and a controller in communication with the drive system. The controller includes a processor, for example, a microprocessor, programmed to: provide at least one scanning pattern for a portion of the area from a first point; signal the drive system to move along a path at least proximate the periphery of the scanned portion to a second point, the second point at a different location than said first point; and provide at least one scanning pattern for a portion of the area from the second point.

Summary of Invention Paragraph:
[0012] Another embodiment is directed to a method for area coverage by an autonomous machine, such as a robot or the like. This method includes scanning a portion of the area in accordance with at least one scanning pattern, from a first point; moving along a path at least proximate the periphery of the scanned portion to a second point, the second point at a different location than the first point; and scanning a portion of the area in accordance with at least one scanning pattern, from the second point. In this method moving along the path to the second point can be either a movement of a predetermined length (distance) or the length or distance of travel can be determined dynamically.

Brief Description of Drawings Paragraph:
[0046] FIGS. 24A and 24B are flow diagrams of an example navigation process used by the apparatus of the invention; and

Detail Description Paragraph:
[0050] The apparatus 20 is formed of multiple systems, including a power system, drive (motion) system, navigation system, payload, or vacuuming system, bumper system, sensing (including obstacle detecting) systems, all coupled to a control system 1000 (FIG. 23), allowing for autonomous operation. This autonomous operation includes for example, vacuum cleaning or vacuuming, and other surface cleaning operations and movement therefore, by the apparatus 20. The apparatus 20 also includes numerous other systems, shown and detailed below.

Detail Description Paragraph:
[0052] In normal operation, the drive wheels 72 are forward of the support wheel 74, such that the apparatus 20 moves in the direction of the arrow 75, this arrow indicating the "forward" direction. Accordingly, for description purposes of this document, the terms "forward" and "front" will refer to direction or orientation from the support wheel 74 to the drive wheels 72, while the terms "rear" and "backward" will refer to the direction or orientation opposite of arrow 75, the direction from the drive wheels 72 to the support wheel 74 (and associated electronics). Drive wheels 72 are driven independently of each other, so as to allow for steering (turning and directional changes), and define the steering system 1030 (FIG. 23). These drive wheels 72 (forming the steering system 1030) couple with the support wheel 74, to form the drive system 1040 (FIG. 23). The steering system 1030 and drive system 1040 couple with the control system 1000. Additionally, the drive wheels 72 and support wheel 74 couple with the navigation system (processed through the microprocessor 1004 in FIG. 23).

Detail Description Paragraph:
[0101] Based on these calculations of distance and displacement, the control system 1000 can adjust the steering 1030 and drive 1040 systems accordingly, to properly position the apparatus 20. The control system 1000 with this information can also control the navigation system accordingly.

Detail Description Paragraph:
[0110] The transmitters 600a, 600b, by being arranged at this angle .THETA. can detect the desired doors, and entryways for these doors, while distinguishing them from other locations, such as under tables, counters or the like. In operation, the transmitters 600a, 600b, emit light beams 609a, 609b (illustrated in FIGS. 21A and 21B for description purposes). The range for the receiver 600 is also represented by a beam 610 (also, only for description purposes).

Detail Description Paragraph:
[0117] For example, the obstacle sensors may be units, such as 40 Khz ultrasonic transducer, Part No. 400PT160, from Prowave. These ultrasonic sensors 34, 35 36a, 36b, 37 define an array, and function as proximity sensors (of a proximity sensing system), that when coupled with the control system, can provide a low resolution image of the obstacle path in from of the apparatus 20.

Detail Description Paragraph:
[0125] For example, the control system 1000 can be programmed to perform a travel mode, where once signaled, typically by the remote controller 46, and the signal is received by one of the remote control sensors 40, the apparatus 20 navigates its way to a point proximate the remote controller 46, from its present location. This is known as the "call me" function, and typically is a dedicated key on the remote controller 46, but could also be a code or the like. Navigation and movement to the point proximate the remote controller 46 can be wholly or partially in accordance with the sensors and associated systems and portions of the exemplary navigation program, detailed below (in blocks 1201-1244 of FIG. 24). Navigation back to the point proximate to the remote controller can also be partially or wholly by a beam riding mechanism, where the beam from the remote controller 46 is tracked by the control system 1000 and the apparatus 20 is rotated and maneuvered to the point proximate the remote controller 46.

Detail Description Paragraph:
[0127] The navigation system and remote control command processing are through the microprocessor 1004. There functions, as well as others are directly integrated into the microprocessor 1004.

Detail Description Paragraph:
[0130] The main board 1002 and microprocessor 1004 are also coupled to the steering system 1030, that includes left 1032a and right 1032b drive motors and

corresponding left 1034a and right 1034b odometers, associated with the respective drive wheels 72. This drive system 1040 also includes the angle sensing system 1042 and odometry system 1044 of the guide wheel 74. The navigation system also couples to these steering 1030 and drive 1040 systems through the main board 1002.

Detail Description Paragraph:
[0132] Additionally, there is a coupling to the leash system 1084, that controls the leash 28 and associated components, that couples with the other systems, through the main board 1002/microprocessor 1004. The main board 1002/microprocessor 1004 can also couple to additional systems 1090, that include for example, supplemental proximity sensing systems, supplemental navigation systems, etc.

Detail Description Paragraph:
[0133] FIG. 24A is a flow diagram indicating an example process of navigation and scanning for movement of the apparatus 20 for vacuum cleaning or the like. For example, this process 1200 can be implemented by the microprocessor 1004. It is typically preprogrammed therein and coupled with the control system 1000 and main board 1002 will be performed by the apparatus 20.

Detail Description Paragraph:
[0145] Alternately, the contour movements in blocks 1232 and 1242 can be replaced with point to point navigation, as detailed above. The determination as to whether to make a contour movement or point to point navigation can be programmed into the microprocessor 1004.

Detail Description Paragraph:
[0147] FIG. 24B is a flow diagram indicating another example process of navigation and scanning for movement of the apparatus 20 for vacuum cleaning or the like. For example, this process 1250 can be implemented by the microprocessor 1004. It is typically preprogrammed therein and coupled with the control system 1000 and main board 1002 will be performed by the apparatus 20.

Detail Description Paragraph:
[0153] L.sub.i is the series L.sub.1 to L.sub.n, and L.sub.1 to L.sub.n are the lengths of each straight line portion of the scanned pattern;

Detail Description Paragraph:
[0157] Turning to FIG. 25, there is detailed another function of the invention. Here the apparatus 20 can be confined to specific areas, by the placement of one or more coded transmitters 1300 at various locations in a room. The transmitter 1300 functions as a "virtual" wall.

CLAIMS:

7. An apparatus for autonomous operation over an area comprising: a drive system; and a controller in communication with said drive system, said controller including a processor programmed to: provide at least one scanning pattern for a portion of said area from a first point; signal said drive system to move along a path at least proximate the periphery of the scanned portion to a second point, said second point at a different location than said first point; and provide at least one scanning pattern for a portion of said area from said second point.

10. The apparatus of claim 9, wherein said length of said path (D) determined dynamically is in accordance with the formula: D=[K.sub.1.multidot.d] [.SIGMA.L.sub.i/max{L.sub.i}]+[K.sub.2.multidot.max- {L.sub.i}]where, L.sub.i is the series L.sub.1 to L.sub.n, and L.sub.1 to L.sub.n are the lengths of each straight line portion of the scanned pattern; K.sub.1 and K.sub.2 can be, for example, K.sub.1=0.8, K.sub.2=1, where L.sub.i are measured in meters; and d is the diameter of the apparatus, for example apparatus 20, expressed in meters.

22. A method for area coverage by an autonomous machine comprising: scanning a portion of said area in accordance with at least one scanning pattern, from a first point; moving along a path at least proximate the periphery of said scanned portion to a second point, said second point at a different location than said first point; and scanning a portion of said area in accordance with at least one scanning pattern, from said second point.

25. The method of claim 22, wherein said determining the length of said path (D) dynamically is in accordance with the formula: D=[K.sub.1.multidot.d] [.SIGMA.L.sub.i/max{L.sub.i}]+[K.sub.2.multidot.max- {L.sub.i}]where, L.sub.i is the series L.sub.1 to L.sub.n, and L.sub.1 to L.sub.n are the lengths of each straight line portion of the scanned pattern; K.sub.1 and K.sub.2 can be, for example, K.sub.1=0.8, K.sub.2=1, where L.sub.i are measured in meters; and d is the diameter of the apparatus, for example apparatus 20, expressed in meters.

L14: Entry 12 of 12 File: USPT Feb 9, 1971

DOCUMENT-IDENTIFIER: US 3562633 A
**** See image for Certificate of Correction ****
TITLE: TRANSMITTER AND RECEIVER ELECTRODE METHOD AND APPARATUS FOR SENSING PRESENCE AND PROXIMITY OF UNDERWATER OBSTRUCTIONS

Brief Summary Text (1):
This invention relates to methods and means for object detection and more particularly to improved methods and means for sensing the proximity of an underwater object to an electrode immersed in the water. It is particularly applicable to sensing obstructions to passage of boats, ships and the like in waterways and inherently lends itself to operation as a channel follower and/or depth finder.

Brief Summary Text (4):
A primary object of the present invention is the provision of an improved method and means for sensing the presence and proximity of an electric terminal immersed in a fluid medium to an object immersed in the fluid medium.

Brief Summary Text (5):
Another object is the provision of an improved method and means for sensing the presence and proximity of an underwater electric terminal to underwater objects and obstructions to navigation such as a channel or river bank or wall; lake, river and ocean bottoms; posts, buoys, mines and the like.

Brief Summary Text (10):
And a still further object is the provision of an improved method and means for sensing the presence and proximity of underwater objects without the use of such long ranging interceptable and position disclosing signals as sound, light and the like.

Brief Summary Text (11):
And another object is the provision of an improved method and means for sensing the presence and proximity of underwater objects to underwater electrodes with only relatively minor corrosion effects even in salt water.

Brief Summary Text (12):
These objects, features and advantages are achieved generally by providing a pair of transmitter electrodes adapted for fixing in spaced relation to each other in the fluid medium encompassing the object whose presence is to be sensed, an oscillator coupled for applying an alternating potential across the transmitter electrodes, at least one receiver electrode adapted for fixing between and in spaced relation to the transmitter electrodes in the fluid medium, and an electric signal measuring circuit coupled to the receiver electrode for measuring received electric signal changes in the receiver electrode with corresponding changes in relative position of the object and the receiver electrode.

Brief Summary Text (15):
By providing a second receiver electrode in line with the transmitter electrodes

with each receiver electrode equidistant from a center position between the transmitter electrodes, and adapting the measuring circuit to measure the received signal potential across the receiver electrodes with respect to a known reference, improved depth finder operation for boats, ships and the like is thereby achieved.

Brief Summary Text (19):
By providing a separate pair of receiver electrodes in transverse relation to the transmitter electrodes and closer to one of the transmitter electrodes than the other and coupled to the measuring circuit for measurement of difference in received signal across the transversely positioned receiver electrodes, sensitivity to channel effect is thereby achieved, as well as a structure for operation as a combined channel follower and depth finder for boats, ships and the like.

Detailed Description Text (1):
Referring to FIG. 1 in more detail, a preferred embodiment of an electrical device for sensing the presence and proximity of a material object in a fluid medium is designated generally by the numeral 10 which for illustrative purposes is in the form of a channel follower and depth finder particularly adapted for operation with a boat 12. While the channel follower and depth finder 10 is for illustrative purposes the preferred embodiment of the present invention and constitutes a major application of the invention, it should be understood that the FIG. 1 embodiment and principles involved therein also have other important applications as will become apparent as this description progresses.

Detailed Description Text (2):
The channel follower and depth finder 10 has a conventional oscillator 14 having preferably a square wave 16 voltage signal output across a primary 18 of an isolation transformer 20 having a secondary 22 with one side electrically coupled by an electric cable 23 to a transmitter electrode 24 fixed to extend downwardly (FIG. 14) from the bottom of the boat at centerline 26 at the prow of the boat 12 and in electrical engagement with the water 13 supporting the boat. The other side of the isolation transformer secondary 22 is coupled through an electric cable 28 to a second electrode 30 preferably fixed to extend downwardly from the bottom of the boat 12 on the boat centerline 26 at the stern and in electrical engagement with the supporting water 13.

Detailed Description Text (10):
The oscillatory voltage signal 16 from the oscillator 14 appears through the isolation transformer 20 across the transmitter electrodes 24 and 30. In this regard, it has been empirically found that the channel follower receiver electrode 102 or 104, which ever is the nearer to a shore bank or wall, will more nearly approach the potential of the nearer transmitting electrode which in the present instance is the transmitting electrode 30. The channel follower receiver electrodes 102 and 104, each approximate a potential between the potentials of the transmitting electrodes 24 and 30 given by linear geometry --analogous to a slide wire resistor --if the water 13 becomes so shallow as to be considered a thin film around the boat 12. However, if the water 13 about the boat 12 is very deep, the channel follower receiver electrodes 102 and 104 more nearly approach the midpotential between the transmitter electrodes 24 and 30, even though the channel follower receiver electrodes 102 and 104 are offset by the distance 106. This observed phenomenon which is herein referred to as the channel follower effect was experimentally verified and is represented qualitatively in the FIG. 2 graph. The curve 111 in FIG. 2 represents the potential of a single electrode such as 102 when placed on the centerline 26 and the boat is close to a channel wall or bank while the depth of the water is varied. Curve 113 represents the potential of the same electrode when the boat 12 is in open water on all sides and only the depth of the water is varied. It will be noted that these experimentally found curves show that two channel follower terminals such as 102 and 104, each located respectively on the port and starboard sides of the boat 12 will be different distances from a bank or wall near one side of the boat 12 and will thereby be at different potentials

regardless of depth of water.

Detailed Description Text (16):
In the operation of the FIG. 1 depth finder, the moveable arms 66 and 78 of the selector switch 68 are moved upwardly to electrically engage the depth finder switch poles 64 and 80 respectively as shown in FIG. 1. The oscillatory signal 16 from the oscillator 14 across the transmitter electrodes 24 and 30 effects a current through the transmitter electrodes 24 and 30 and water 13 surrounding the boat 12. The depth finder receiver electrodes 60 and 84 being offset a distance 86 and 88 respectively from the center point 90 between the transmitter electrodes 24 and 30 will always have a finite potential because of their offset positions. Voltage across the depth finder receiver electrodes 60 and 84 is found to be a function of the depth of water 13 under the boat 12 for a given current of the transmitter electrodes 24 and 30 and may be represented by the curve 119 in the graph of FIG. 9. Referring to FIG. 9, it will be noted that the portion 120 of the curve 119 is the response for deep water which represents no problem to navigation, whereas, the remainder of the curve 119 becomes increasingly linear and sensitive as the depth of water decreases and the need for knowledge as to depth increases.

Detailed Description Text (17):
For the purpose of providing a suitable reference or bridge balance for the potential across the depth finder receiver electrodes 60 and 84, a portion of the signal between the transmitter electrodes 24 and 30 is picked up by the receiver electrodes 32 and 34 for creating a potential across the voltage divider resistor 38 and potentiometer resistor 40. Thereby, adjustment of the potentiometer resistor wiper 54 permits the creation of a suitable balancing potential in the circuit comprised of depth finder receiver electrode 60, electric cable 58, balancing transformer secondary 56, electric cable 62, switch pole 64, switch arm 66 and electric cable 70 to the variable gain amplifier 72. It will be noted that the wiper arm 54 on the potentiometer resistor 40 makes possible a wide range of both positive and negative balancing potentials. Thus by suitable adjustment of the wiper 54 and gain control 74 of the amplifier 72, the indicator hand 114 may be set at full scale reading when the boat 12 is in deep water and the face of the indicator 112 marked for position of the indicator hand 114 for various known diminishing depths of water to that which is minimal for passage of the boat 12, such as for example indicated by the points 120, 122 and 124 on the curve 119 in FIG. 9.

Detailed Description Text (68):
FIG. 11 illustrates a further embodiment which combines both a channel follower and a depth finder having capacity for giving simultaneous readings of depth and direction for best channel course. In FIG. 11 an oscillator 350 which may be similar to the oscillator 14 is coupled to apply an alternating voltage signal across a pair of transmitter electrodes 352 and 354 fixed to extend downwardly from the bottom of a boat 358 on longitudinal centerline 356 and in electrical engagement with the supporting water. The transmitter electrodes 352 and 354 may be similar to the electrodes 24 and 30 of FIG. 1. A pair of reference receiver electrodes 360 and 362, which may be similar to the receiver electrodes 32 and 34 of FIG. 1 and similarly placed, are electrically coupled through a potentiometer resistor 364 carrying an adjustable wiper 366 coupled to one end of a primary of a depth finder transformer 368, the other end of which is coupled to a centertap 370 of a primary of a channel follower transformer 372 is coupled The primary of the channel follower transformer 372 is coupled across a pair of combined channel follower and depth finder electrodes 374 and 376. The receiver electrodes 374 and 376 may be similar to the receiver electrodes 102 and 104 of FIG, 1 and placed a distance 378 from a center point 380 which is preferably equal to one-fifth to one-tenth the distance between the electrodes 352 and 354. While the spacing 378 is shown forward of the center point 380 as distinguished from rearward spacing 116 in FIG, 1, such forward spacing 378 results in reversal of attitude sense to position sense signal polarity and is shown here to illustrate that such forward spacing is

usable in the present invention when properly interpreted. The transverse spacing 382 between the electrodes 374 and 376 is also preferably equal to one-fifth to one-tenth the distance between the transmitter electrodes 352 and 354.

Detailed Description Text (72):
The FIG. 12 embodiment provides indication of an immersed obstruction such as a post, mine or other material body 392, as relative movement between it and a boat 394 or other vessel carrying the FIG. 12 embodiment occurs. In FIG. 12 an oscillator 396 such as the oscillator 14 is coupled to apply an alternating potential signal across transmitter electrodes 398 and 400. The transmitter electrodes 398 and 400 may be similar to the electrodes 24 and 30 of FIG, 1 and similarly placed on a centerline 402 and extending downwardly in electrical engagement with water supporting the boat 394. A pair of receiver electrodes 406 and 408 which may be similar to electrodes 102 and 104 of FIG, 1 are fixed to extend downwardly in engagement with the supporting water as in FIG, 1 except in that they are on a transverse line 410 midway between the transmitter electrodes 398 and 400. The receiver electrodes 406 and 408 are separated a distance 412 preferably equal to one-fifth to one-tenth the distance between the transmitter electrodes 398 and 400 and equidistant from the centerline 402. The receiver electrodes 406 and 408 are coupled to the input of an amplifier 414 which may be similar to the amplifier 72 of FIG. 1. The output of the amplifier 414 is coupled to an electric meter 416 which may be similar to the meter 112 of FIG, 1.

CLAIMS:

1. In an apparatus for sensing proximity of material obstructions in a fluid medium the combination of a pair of transmitter electrodes in spaced relation to each other in electrical engagement with the fluid medium, means for applying an electrical potential signal across said transmitter electrodes, at least one receiver electrode in electrical engagement with the fluid medium between and in spaced relation to the transmitter electrodes at a position along an imaginary line of symmetry through said transmitter electrodes closer to a center position between said transmitter electrodes than to either of said transmitter electrodes and spaced a substantial distance from said center position, carrier means rigidly fixing said electrodes in place for movement in said medium with said electrodes carried in the same relative positions with respect to each other, means coupled to said transmitter electrodes for deriving a reference potential, and electric signal measuring means coupled to the receiver electrode and reference means for measuring said signal at said receiver electrode with respect to said derived reference potential and including indicator means calibrated for sad signal measurement to indicate proximity of such obstruction beneath said electrodes.

4. The combination as in claim 3 wherein said measuring means includes a phase sensitive detector coupled for comparing said receiver electrode signal as appearing with respect to said reference potential to said oscillatory signal applied to the transmitter electrodes.

7. In an apparatus for sensing proximity of material obstructions in a fluid medium the combination of a pair of transmitter electrodes in spaced relation to each other and in electrical engagement with the fluid medium, means for applying an oscillatory electric potential signal across said transmitter electrodes, at least one pair of receiver electrodes in electrical engagement with the fluid medium on an imaginary receiver electrode line in transverse relation to an imaginary line of symmetry through said transmitter electrodes and on respective sides of said line of symmetry, said receiver electrode line being substantially closer to one of said transmitter electrodes than the other of said transmitter electrodes, carrier means rigidly fixing said electrodes in place for movement in said medium with said electrodes carried in the same relative positions with respect to each other, means coupled for measuring the signal across said receiver electrodes and including an indicator calibrated for said signal measurement to indicate the side proximate to

a laterally disposed obstruction.

9. The combination as in claim 7 wherein said receiver electrodes are separated by a distance equal to about one-tenth to one-fifth the distance between said transmitter electrodes and said imaginary receiver electrode line is displaced from a midpoint between said transmitter electrodes by a distance equal to about one-tenth to one-fifth the distance between said transmitter electrodes.

10. The combination as in claim 7 wherein said signal means includes a square wave oscillator; and said measuring means includes an amplifier coupled to said receiver electrodes, a phase sensitive detector coupled to said amplifier and oscillator for comparing said receiver electrodes and oscillator signals, indicator means coupled to said phase sensitive detector and calibrated for neutral indication when said transmitter electrodes are aligned with and in the center of a channel and for indication on respective sides of said neutral indication when said transmitter electrodes are displaced toward respective sides of said channel.

11. The combination as in claim 9 wherein said signal means includes a square wave oscillator; and said measuring means includes an amplifier coupled to said receiver electrodes, a phase sensitive detector coupled to said amplifier and oscillator for comparing said receiver electrodes and oscillator signals, indicator means coupled to said phase sensitive detector and calibrated for neutral indication when said transmitter electrodes are aligned with and in the center of a channel and for indication on respective sides of said neutral indication when said transmitter electrodes are displaced toward respective sides of said channel.

13. In an apparatus for sensing material obstructions in a water medium the combination of a pair of transmitter electrodes in spaced relation to each other in electrical engagement with said medium; means for applying an oscillatory electrical potential signal across said transmitter electrodes; two receiver electrodes in line with said transmitter electrodes and in electrical engagement with said medium, each receiver electrode being displaced on a respective side form a center position between said transmitter electrodes with the distance between the receiver electrodes being between one-tenth and one-fifth said transmitter electrode spacing; and electric signal measuring means coupled to said receiver electrodes for measuring the signal at said receiver electrodes, said measuring means including a signal balancing circuit coupled to said signal applying means and receiver electrodes for providing an electric bridge balance for said receiver electrode signal, a third pair of electrodes with each fixed close to a corresponding one of said transmitter electrodes, a voltage divider resistor and potentiometer resistor coupled in parallel across said last mentioned electrodes, a centertap on the voltage divider resistor, an adjustable wiper on the potentiometer resistor, and a balancing transformer having a primary coupled to said centertap and adjustable wiper, and a secondary coupled in series with one of said displaced receiver electrodes.

14. The combination as in claim 13 wherein said measuring circuit has additionally means for amplifying said bridge balanced receiver electrode signal, and a phase sensitive detector coupled to said amplifier means and transmitter electrode signal applying means for comparing said amplified signal and transmitter means signal.

15. The combination as in claim 14 having additionally a pair of receiver channel follower electrodes in spaced relation to each other transversly to and on respective sides of said in line electrodes and displaced from said center position by a distance equal to one-fifth to one-tenth of the spaced relation of said transmitter electrodes, and means for coupling said channel follower receiver electrodes to said signal measuring means.

17. In an apparatus for sensing material obstructions in a water medium the combination of a pair of transmitter electrodes in spaced relation to each other in

electrical engagement with said medium; means for applying an oscillatory electrical potential signal across said transmitter electrodes; two receiver electrodes in spaced relation to each other, equally distant from a center position between said transmitter electrodes, in transverse relation to said transmitter electrodes and displaced from said center position by a distance equal to between one-fifth and one-tenth said transmitter electrode spacing; and electric signal measuring means coupled to said receiver electrodes for measuring the signal at said receiver electrodes, said measuring means including a channel follower transformer with a primary coupled across said receiver electrodes, a centertap on said primary, a reference signal source, and a depth finder transformer having a primary coupled to said centertap and reference signal source, thereby effecting across said channel follower transformer electric signals having an intensity correlation to orientation of said transmitter electrodes in a channel and across said depth finder transformer electric signals having an intensity correlation to depth of said medium.

18. The method of sensing the presence and proximity of a material obstruction in a fluid medium comprising the steps of applying an oscillatory electric signal potential to the fluid medium across two spaced apart small area positions in said medium, measuring the resulting signal potential at a third small area position in the medium with respect of a fourth small area position under conditions of known material obstructions within the useful measuring range, the third position and fourth position being on an imaginary line transverse to an imaginary line of symmetry through said first mentioned positions and on respective sides of said line of symmetry and substantially closer to one of said first mentioned positions than to the other of the first mentioned positions, and indicating the amount of any change in the measured signal potential at the third position under conditions of unknown material obstructions in the fluid medium in terms of the side proximate to a laterally disposed obstruction.

20. The method of sensing the presence and proximity of material obstruction in a fluid medium comprising the steps of applying an oscillatory electric potential to the fluid medium across two spaced apart small area positions in said medium, measuring the resulting signal potential at a third small area position in the medium with respect to a fourth small area position under conditions of known material obstruction within the useful measuring range, the third and fourth positions being along an imaginary line of symmetry through the first and second positions and spaced a substantial distance from a center point between said first and second positions, and indicating the amount of any change in the measured signal potential at the third position with respect to said fourth position under unknown material obstruction in the fluid medium in terms of proximity to such obstruction beneath said positions.

22. In a ship mounted apparatus for sensing proximity of material underwater obstructions to movement of said ship through the water to facilitate guidance of said ship in manner to avoid contact with such obstructions, the combination of a pair of transmitter electrodes mounted on the hull of said ship in spaced relation to each other in electrical engagement with said water, means for applying an electrical potential signal across said transmitter electrodes, at least one receiver electrode mounted on the hull of said ship in electrical engagement with the water between and in spaced relation to the transmitter electrodes at a position which is on an imaginary line of symmetry through said transmitter electrodes and displaced from a center position between said transmitter electrodes by a substantial distance, means coupled to said transmitter electrodes for deriving a reference potential and electric signal measuring means coupled to said receiver electrode and reference means for measuring the signal at said receiver electrode with respect to said derived reference potential and including indicator means calibrated for said signal measurement to indicate proximity of such obstruction beneath said ship.

26. The combination as in claim 22 wherein said signal across said transmitter electrodes is an oscillatory signal, and said measuring means includes an amplifier coupled for amplifying said receiver electrode signal with respect to said reference potential, and a phase sensitive detector coupled for comparing said oscillatory signal to said amplified signal for improving the accuracy of said signal measurement on said indicator.

27. The combination as in claim 26 wherein said transmitting means includes a switching wave generator for effecting said oscillatory electrical potential signal.

28. In a ship mounted apparatus for sensing direction and proximity of massive underwater obstructions to movement of said ship through the water to facilitate guidance of said ship in manner to avoid contact with any of said obstructions, the combination of a pair of transmitter electrodes mounted fore and aft on the hull of said ship in spaced relation to each other in electrical engagement with said water, means for applying an electrical potential signal across said transmitter electrodes, a pair of receiver electrodes separate from said transmitter electrodes mounted in transverse relation to said transmitter electrodes on the hull of said ship in electrical engagement with the water and on respective sides of an imaginary line of symmetry through said transmitter electrodes, each of said receiver electrodes being substantially closer to one of said transmitter electrodes than the other of said transmitter electrodes and in spaced relation to the transmitter electrodes, and electric signal measuring means coupled to said receiver electrode pair for measuring the signal across said receiver electrodes, said measuring means including indicator means calibrated for indication of side and proximity of said ship to such massive barrier.

31. The combination as in claim 30 wherein said electric signal potential across said transmitter electrodes is an oscillatory electrical signal potential, and said measuring means includes a differential amplifier coupled for amplifying the signal differential across said receiver electrode pair.

32. The combination as in claim 31 wherein said measuring means additionally includes a phase sensitive detector coupled for comparing said amplified signal from said amplifier and said oscillatory signal from said transmitter electrode applying means for improving accuracy of said receiver electrode signal measurement.

33. The combination as in claim 32 wherein said means for applying an electrical potential signal across said transmitter electrodes includes a switching wave generator for effecting said applied oscillatory electrical potential signal.

35. The combination as in claim 31 having additionally means coupled to said transmitter electrodes for providing a reference potential signal; and said measuring means includes means for obtaining a receiver electrical potential signal intermediate the signal potentials between said pair of receiver electrodes, means for measuring said intermediate signal with respect to said reference, and an indicator calibrated for said measurement to indicate depth of water beneath said ship.

36. The combination as in claim 28 wherein a second pair of receiver electrodes are mounted on said hull in electrical engagement with the water and in parallel relation to said transmitter electrodes, and said measuring means includes an indicator calibrated for signal measurements across said second receiver electrode pair to indicate proximity of such obstructions disposed below the level of said ship.

38. The combination as in claim 37 wherein said electric signal potential across said transmitter electrodes is an oscillatory electrical signal potential, and said

measuring means has additionally means coupled to said transmitter and receiver electrodes for modifying the electrical signal potential across said receiver electrode pair to facilitate correlation of said receiver electrode signals for said indication of proximity of such obstructions.

39. The combination as in claim 38 having additionally another pair of receiver electrodes at the bottom of said hull in transverse relation to said transmitter electrodes and an indicator arranged for operation with said transverse electrodes and calibrated for causing the signal across said pair of transverse electrodes to indicate proximity of such obstruction in lateral relation to said ship.

42. The combination as in claim 41 wherein said hull is substantially symmetrical on each side of an imaginary centerline running longitudinally at the bottom of said hull, said transmitter electrodes are fixed to said hull in said forward and rearward positions for substantially symmetrical current conduction through said water on respective sides of said centerline when said water is free of obstructions, and said receiver electrodes are fixed to said hull below the water level on respective sides of said centerline.

46. In an apparatus for sensing material obstructions in a water medium the combination of a pair of transmitter electrodes in spaced relation to each other in electrical engagement with said water medium, means for applying an oscillatory electrical potential signal across said transmitter electrodes, at least one receiver electrode in electrical engagement with the water medium between and in line with the transmitter electrodes at a position which is displaced from a center position between said transmitter electrodes by a distance equal to between one fifth and one tenth said transmitter electrode spacing, carrier means rigidly fixing said electrodes in place for movement in said medium with said electrodes carried in the same relative positions with respect to each other, and electric signal measuring means coupled to the receiver electrode for measuring said signal at said receiver electrode, said measuring means including a circuit coupled to said transmitter electrodes for providing an electric reference signal for measurement of said receiver electrode signal, said last mentioned circuit including a pair of receiver electrodes with each of said pair fixed close to a corresponding one of said transmitter electrodes for providing the coupling thereto.

47. In an apparatus for sensing material obstructions in a water medium the combination of a pair of transmitter electrodes in spaced relation to each other in electrical engagement with said water medium, means for applying an oscillatory electrical potential signal across said transmitter electrodes, a first receiver electrode in electrical engagement with the water medium between and in line with the transmitter electrodes at a position which is displaced from a center position between said transmitter electrodes, a second receiver electrode in electrical engagement with the water medium in line with the transmitter electrodes and displaced from said center position between said transmitter electrodes by the same distance as said first mentioned receiver electrode and on the opposite side of said center position from that of said first receiver electrode, said receiver electrodes being separated by a distance equal to about one tenth to one fifth the distance between said transmitter electrodes, and electric signal measuring means coupled to both said receiver electrodes, said measuring means including a signal balancing circuit coupled to said signal applying means and receiver electrodes for providing an electric bridge balance for said receiver electrode signal, said balancing circuit including a voltage divider resistor and potentiometer resistor, means coupling said voltage divider resistor and potentiometer resistor in parallel across said transmitter electrodes, a centertap on the voltage divider resistor, an adjustable wiper on the potentiometer resistor, a balancing transformer having a primary coupled to said centertap and adjustable wiper and a secondary coupled in series with one of said displaced receiver electrodes.

48. In a ship mounted apparatus for sensing massive underwater obstructions to movement of said ship through the water to facilitate guidance of said ship in manner to avoid contact with any of said obstructions, the combination of a pair of transmitter electrodes mounted in spaced relation to each other fore and aft of said ship along a centerline of the hull at the bottom of said ship and in electrical engagement with said water, means for applying an oscillatory electrical signal potential across said transmitter electrodes, a pair of receiver electrodes separate from said transmitter electrodes mounted on the hull of said ship in transverse relation to said transmitter electrodes on respective sides of said centerline, means coupled to said transmitter electrodes for providing a reference potential signal; and electric signal measuring means coupled to said receiver electrode pair for measuring the signal across said receiver electrodes, said measuring means including a differential amplifier coupled for amplifying the signal differential across said receiver electrode pair, an indicator calibrated for a center of channel indication for massive channel barriers symmetrically located on respective sides of said ship and corresponding off center channel indication as said ship is disposed nearer to a corresponding one of said channel barriers, means for obtaining a receiver electrical potential signal intermediate the signal potentials between said pair of receiver electrodes, means for measuring said intermediate signal with respect to said reference, and an indicator calibrated for said last mentioned measurement to indicate depth of water beneath said ship.

49. In a ship mounted apparatus for sensing massive underwater obstructions to movement of said ship through the water to facilitate guidance of said ship in manner to avoid contact with any of said obstructions, the combination of a pair of transmitter electrodes mounted in spaced relation to each other along a centerline of the hull at the bottom of said ship and in electrical engagement with said water, means for applying an oscillatory electrical signal potential across said transmitter electrodes, a pair of receiver electrodes separate from said transmitter electrodes mounted at the bottom of said hull along said centerline in electrical engagement with the water and in spaced relation to said transmitter electrodes, and electric signal measuring means coupled to said receiver electrode pair for measuring the signal across said receiver electrodes, said measuring means including an indicator calibrated for said signal measurements across said receiver electrode pair to indicate proximity of such obstruction disposed below the level of said ship and means coupled to said transmitter and receiver electrodes for modifying the electrical signal potential from across said receiver electrode pair to facilitate correlation of said receiver electrode signals for said indication of proximity of such obstructions.

Previous Doc Next Doc Go to Doc#

Hit List

Your wildcard search against 10000 terms has yielded the results below.
Your result set for the last L# is incomplete.
The probable cause is use of unlimited truncation. Revise your search strategy to use limited truncation.

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs
Generate OACS

Search Results - Record(s) 1 through 5 of 5 returned.

☐ 1. Document ID: US 20050156881 A1

L20: Entry 1 of 5 File: PGPB Jul 21, 2005

PGPUB-DOCUMENT-NUMBER: 20050156881
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20050156881 A1

TITLE: Closed-loop sensor on a solid-state object position detector

PUBLICATION-DATE: July 21, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Trent, Raymond A. JR.	San Jose	CA	US	
Shaw, Scott J.	Fremont	CA	US	
Gillespie, David W.	Los Gatos	CA	US	
Heiny, Christopher	Boulder Creek	CA	US	
Huie, Mark A.	San Carlos	CA	US	

US-CL-CURRENT: 345/157

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

☐ 2. Document ID: US 20040252109 A1

L20: Entry 2 of 5 File: PGPB Dec 16, 2004

PGPUB-DOCUMENT-NUMBER: 20040252109
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20040252109 A1

TITLE: Closed-loop sensor on a solid-state object position detector

PUBLICATION-DATE: December 16, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47

Trent, Raymond A. JR.	San Jose	CA	US
Shaw, Scott J.	Fremont	CA	US
Gillespie, David W.	Los Gatos	CA	US
Heiny, Christopher	Boulder Creek	CA	US
Huie, Mark A.	San Carlos	CA	US

US-CL-CURRENT: 345/174

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

---

☐ 3. Document ID: US 20040017355 A1

L20: Entry 3 of 5   File: PGPB   Jan 29, 2004

PGPUB-DOCUMENT-NUMBER: 20040017355
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20040017355 A1

TITLE: Cursor control systems and methods

PUBLICATION-DATE: January 29, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Shim, Youngtack	Sunnyvale	CA	US	

US-CL-CURRENT: 345/157

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

---

☐ 4. Document ID: US 20030120389 A1

L20: Entry 4 of 5   File: PGPB   Jun 26, 2003

PGPUB-DOCUMENT-NUMBER: 20030120389
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030120389 A1

TITLE: Robotic vacuum cleaner

PUBLICATION-DATE: June 26, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Abramson, Shai	Pardesia		IL	
Levin, Shalom	Atlit		IL	
Zaslavsky, Ran	Kfar Saba		IL	

US-CL-CURRENT: 700/245; 318/568.12

☐ 5. Document ID: US 20030060928 A1

L20: Entry 5 of 5 File: PGPB Mar 27, 2003

PGPUB-DOCUMENT-NUMBER: 20030060928
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030060928 A1

TITLE: ROBOTIC VACUUM CLEANER

PUBLICATION-DATE: March 27, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Abramson, Shai	Pardesia		IL	
Levin, Shalom	Atlit		IL	
Zaslavsky, Ran	Kfar Saba		IL	

US-CL-CURRENT: 700/245; 701/23

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. D

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Terms	Documents
L18 and (proxim$ near3 sens$)	5

Display Format: - Change Format

Previous Page Next Page Go to Doc#

L20: Entry 1 of 5 File: PGPB Jul 21, 2005

DOCUMENT-IDENTIFIER: US 20050156881 A1
TITLE: Closed-loop sensor on a solid-state object position detector

Abstract Paragraph:
The present disclosure discloses an object position detector. The object position detector comprises a touch sensor formed as a closed loop and having a physical constraint formed on an upper surface of the touch sensor and coextensive with the closed loop. The touch sensor is configured to sense motion of an object proximate to the closed loop. The object position detector also comprises a processor coupled to the touch sensor and is programmed to generate an action in response to the motion on the touch sensor.

Summary of Invention Paragraph:
[0015] c. Hierarchical menus controlled by a pointing device or by key combinations: These have a similar problem to scroll bars, in terms of the complexity of the targeting task that faces the user. First, the user must hit a small target near the edge of a screen, and then the user must navigate along narrow paths to open up additional layers of menu hierarchy. Shortcut keys, which usually consist of key combinations, are typically non-intuitive and hard to remember.

Summary of Invention Paragraph:
[0023] The present disclosure discloses a solid-state object position detector. The solid-state object position detector comprises a touch sensor formed as a closed loop having a physical constraint formed on an upper surface of the touch sensor and coextensive with the closed loop. The touch sensor is configured to sense motion of an object proximate to the closed loop. The object position detector also comprises a processor coupled to the touch sensor and is programmed to generate an action in response to the motion on the touch sensor.

Summary of Invention Paragraph:
[0024] The present disclosure also discloses a solid-state object position detector, comprising a two-dimensional touch sensor having a tactile guide formed on an upper surface of, and coextensive with, the two-dimensional touch sensor. The two-dimensional touch sensor is configured to sense motion of an object proximate to the two-dimensional touch sensor. The solid-state object position detector also comprises a processor coupled to the two-dimensional touch sensor and configured to report only one variable indicating the position, such as the angular position, of an object proximate to the two-dimensional touch sensor. The processor is programmed to generate an action in response to the motion on the two-dimensional touch sensor.

Brief Description of Drawings Paragraph:
[0035] FIG. 2 illustrates a location of a closed-loop sensor on a laptop near a keyboard;

Brief Description of Drawings Paragraph:
[0050] FIG. 24 illustrates a motion on a closed-loop sensor for navigating menus;

Brief Description of Drawings Paragraph:

[0051] FIG. 25 illustrates a motion on a closed-loop sensor for vertically navigating menus using an additional key;

Brief Description of Drawings Paragraph:
[0052] FIG. 26 illustrates a motion on a closed-loop sensor for horizontally navigating within open menus;

Detail Description Paragraph:
[0081] The closed-loop sensor (or several closed-loop sensors) can be disposed in any location that is convenient for its use with a host device, and optional other input devices. A host system can be a computer, a laptop or handheld computer, a keyboard, a pointing device, an input device, a game device, an audio or video system, a thermostat, a knob or dial, a telephone, a cellular telephone, or any other similar device. For example, the closed-loop sensor can be positioned on a laptop near the keyboard as illustrated in FIG. 2. The base 20 of the laptop is illustrated having a keyboard 22, a touch pad (or touch screen) 24, and a closed-loop sensor 26. Alternative positions include positioning the closed-loop sensor on or connecting it to a conventional computer or keyboard. FIG. 3 illustrates the closed-loop sensor 26 disposed on a conventional pointing device 28. Conventional pointing device 28 may have other features, such as left click or right click buttons, which are not shown.

Detail Description Paragraph:
[0083] The closed-loop sensor can be implemented as a stand-alone sensor, which can then be used as a replacement for one or more knobs, sliders, or switches on any piece of electronic equipment. In some cases, it might be desirable to provide visual feedback indicating the "current" setting of the virtual knob, such as a ring of light emitting diodes (LEDs) surrounding the closed-loop region. An Etch-a-Sketch.TM. type of electronic toy can be implemented using a single position detector with two closed-loop sensors or two position detectors with one closed-loop sensor each. Many other toys and consumer appliances currently have knobs used in similar ways that can benefit from the present invention.

Detail Description Paragraph:
[0093] Multiple closed paths can be defined on a single input device, each of which controls different features of the user interface. In this case, it is especially desirable to make the location of each loop path readily apparent to the user by use of one of the above-mentioned means, such as a bezel with multiple openings.

Detail Description Paragraph:
[0096] Once the user's position on the loop path is determined using above-referenced methods, this information can be used in many ways. Successive user locations can be subtracted to decode motion direction or magnitude. This motion can, for example, be converted into scrolling signals or keystrokes that the user interface can interpret.

Detail Description Paragraph:
[0100] Navigating through menus is also easier with the present invention. As illustrated in FIG. 24, a motion either clockwise or counterclockwise (illustrated by arrow 60), on the closed-loop sensor of the object position detector 62 would cause the drop down of menu items 64 on, for example, a computer screen 66. For the purposes of this disclosure, numeral 62 represents an object position detector. As disclosed herein, the object position detector could be any shape. The simplest instance of this is to convert the relative position signal (or instruction) in such a way that the menu is navigated depth-first by sending keystrokes or other messages understood by the graphical user interface (GUI) to indicate intent to navigate a menu. One alternative solution for complex menus is to traverse only the current menu hierarchy level by using the loop method of the closed-loop sensor, and a separate mechanism to switch between levels in the menu. There are many applicable mechanisms, including physical switches that the user presses, regions

on the sensor where the user can tap or draw a suggestive gesture, and the like.

Detail Description Paragraph:
[0106] Many user interface elements can benefit from the closed-loop sensor. Most can be categorized as being similar to controls for scrolling, menus, or value setting controls. For example, selection among icons on a "desktop" can be performed using this method, with a means (such as a gesture on the sensor, a tap on the sensor, a button, or a key) provided for launching the corresponding program once the user is satisfied with the selection. This task can be considered analogous to navigating a menu.

Detail Description Paragraph:
[0107] Navigation along the "tab order" of the elements of a graphical user interface can be performed with a closed-loop sensor. Similarly, navigation between multiple running applications, multiple documents edited by the current application, or multiple modes of a particular application can be accomplished with this control.

Detail Description Paragraph:
[0135] An alternate interpolation method, often used in the art, is centroid interpolation, as illustrated in FIG. 41. This method computes the mathematical centroid of the curve of capacitance measurements and is adapted to closed-loop sensors by locating the peak electrode number i, and then rotating the coordinate system by renumbering each electrode j to j-i+N/2) modulo N. This moves peak electrode i to the approximate center of the sensor for purposes of the centroid calculation. After the centroid calculation produces a position X, the reverse rotation is applied, X'=(X+i-N/2) modulo N, to produce the final angular input object position.

Detail Description Paragraph:
[0142] When using a closed-loop sensor implemented on a two-dimensional touch sensor having both radial and circular sensor electrodes but without a physical constraint (or tactile guide) defining the closed-loop path, it is possible that the input object will gradually move out of the defined loop path. This may result in a variable scaling of the distance traveled to angular velocity, depending on the location of the motion with respect to the center of the motion, which may result in a calculated magnitude of input significantly different from that intended by the user. For example, small motions near the center of the defined loop path map to larger angular velocities than the same small motions near the periphery of the loop path. Users are typically more able to control the absolute distance traveled of the input object than the angle traveled by the input object relative to a defined center. Thus, for an input, in which the distance from the center is not useful, such as scrolling along a page or controlling the volume, users typically expect the output to be mapped to the distance traveled rather than to the angle, and may prefer small motions anywhere in the loop path to generate similar outputs.

Detail Description Paragraph:
[0144] Another method is to use the angular component solely to determine the sign of the traversal along the closed-loop path, and calculate the speed based only on the absolute motion of the object, as illustrated in FIG. 45. For example, given two consecutive points sampled from the closed-loop sensor, the straight-line distance is calculated between these two points (with an approximation to the Pythagorean Theorem or equivalent polar coordinate equations). Additionally, the angular positions corresponding to these two points along the closed-loop path are calculated by one of the means previously discussed. The angle of the second point is subtracted from the angle of the first point, and the sign of this result is used to indicate the direction of motion, while the absolute distance is used to indicate the amount of motion. This results in a more natural feeling correspondence between the motion of the user's input object and the corresponding

variation in the controlled parameter (e.g., scrolling distance, menu traversal, or setting value).

Detail Description Paragraph:
[0145] In the case that the closed-loop sensor is not circular or substantially circular, the algorithms used to calculate position for a circular sensor could still be used to estimate an input object's position. In this case, the algorithm will indicate where the input object(s) is(are) in the closed loop of the closed-loop sensor, and software can decode the exact location based on knowledge of the local electrode design. For example, a closed-loop sensor having a rectangular loop with rounded corners can have software that can differentiate the signals generated by an object very near, or on, the corners versus the signals generated by an object along a linear portion of the rectangle. The previously discussed algorithms can generate this information and compensate.

Detail Description Paragraph:
[0148] The closed-loop sensor of the present disclosure frees users from targeting tasks or from remembering complex combinations of controls by allowing designers of applications or operating systems to reduce scroll bars and other similar display controls to mere indicators of the current scrolled position or control value. If scroll bars and similar display controls can be reduced to mere indicators, their size can be reduced and their positions at the edge of the screen, edge of a window, or other specific location on the screen or window will consume negligible space. Additionally, the freedom offered by reducing scroll bars and similar display controls might allow menus to be less hierarchical, which further reduces control and display complexity.

CLAIMS:

1. A solid-state object position detector for indicating a desired user interface navigation task, comprising: a touch sensor having a plurality of electrodes disposed in a substantially closed loop, said touch sensor configured to sense an object proximate to said substantially closed loop; and a processor coupled to said touch sensor, said processor configured to provide relative motion information about said object moving proximate to said substantially closed loop, said relative motion information representative of a difference between a first position and second position of said object, said relative motion information indicating said desired user interface navigation task.

6. The solid-state object position detector of claim 1, wherein said desired user interface navigation task comprises scrolling.

24. A solid-state object position detector, comprising: a touch sensor having a plurality of electrodes disposed in a substantially closed loop, said touch sensor configured to sense an object proximate to said substantially closed loop; and a processor coupled to said touch sensor, said processor configured to provide positional information about said object proximate to said substantially closed loop in only one coordinate.

27. A solid-state object position detector, comprising: a touch sensor having a plurality of electrodes disposed in a substantially closed loop, said touch sensor configured to sense an object proximate to said substantially closed loop, said plurality of electrodes configured such that adjacent electrodes are interdigitated such that capacitance introduced by the object is measured by a subset of the plurality of electrodes; and a processor coupled to said touch sensor, said processor configured to provide positional information about said object proximate to said substantially closed loop.

L15: Entry 10 of 10 File: USPT Feb 9, 1971

DOCUMENT-IDENTIFIER: US 3562633 A
**** See image for Certificate of Correction ****
TITLE: TRANSMITTER AND RECEIVER ELECTRODE METHOD AND APPARATUS FOR SENSING PRESENCE AND PROXIMITY OF UNDERWATER OBSTRUCTIONS

Brief Summary Text (1):
This invention relates to methods and means for object detection and more particularly to improved methods and means for sensing the proximity of an underwater object to an electrode immersed in the water. It is particularly applicable to sensing obstructions to passage of boats, ships and the like in waterways and inherently lends itself to operation as a channel follower and/or depth finder.

Brief Summary Text (4):
A primary object of the present invention is the provision of an improved method and means for sensing the presence and proximity of an electric terminal immersed in a fluid medium to an object immersed in the fluid medium.

Brief Summary Text (5):
Another object is the provision of an improved method and means for sensing the presence and proximity of an underwater electric terminal to underwater objects and obstructions to navigation such as a channel or river bank or wall; lake, river and ocean bottoms; posts, buoys, mines and the like.

Brief Summary Text (10):
And a still further object is the provision of an improved method and means for sensing the presence and proximity of underwater objects without the use of such long ranging interceptable and position disclosing signals as sound, light and the like.

Brief Summary Text (11):
And another object is the provision of an improved method and means for sensing the presence and proximity of underwater objects to underwater electrodes with only relatively minor corrosion effects even in salt water.

Brief Summary Text (12):
These objects, features and advantages are achieved generally by providing a pair of transmitter electrodes adapted for fixing in spaced relation to each other in the fluid medium encompassing the object whose presence is to be sensed, an oscillator coupled for applying an alternating potential across the transmitter electrodes, at least one receiver electrode adapted for fixing between and in spaced relation to the transmitter electrodes in the fluid medium, and an electric signal measuring circuit coupled to the receiver electrode for measuring received electric signal changes in the receiver electrode with corresponding changes in relative position of the object and the receiver electrode.

Brief Summary Text (13):
By placing the receiver electrode in line with and equidistant from the transmitter

electrodes, an arrangement for effectively sensing the object as a changing potential at the receiver electrode with movement of the object past the electrodes is thereby achieved.

Brief Summary Text (14):
By placing the receiver electrode in line with and closer to one of the transmitter electrodes and adapting the measuring circuit for measuring the receiver electrode potential with respect to a fixed reference, a suitable arrangement for measuring depth of fluid beneath the electrodes is thereby achieved.

Brief Summary Text (15):
By providing a second receiver electrode in line with the transmitter electrodes with each receiver electrode equidistant from a center position between the transmitter electrodes, and adapting the measuring circuit to measure the received signal potential across the receiver electrodes with respect to a known reference, improved depth finder operation for boats, ships and the like is thereby achieved.

Brief Summary Text (19):
By providing a separate pair of receiver electrodes in transverse relation to the transmitter electrodes and closer to one of the transmitter electrodes than the other and coupled to the measuring circuit for measurement of difference in received signal across the transversely positioned receiver electrodes, sensitivity to channel effect is thereby achieved, as well as a structure for operation as a combined channel follower and depth finder for boats, ships and the like.

Detailed Description Text (1):
Referring to FIG. 1 in more detail, a preferred embodiment of an electrical device for sensing the presence and proximity of a material object in a fluid medium is designated generally by the numeral 10 which for illustrative purposes is in the form of a channel follower and depth finder particularly adapted for operation with a boat 12. While the channel follower and depth finder 10 is for illustrative purposes the preferred embodiment of the present invention and constitutes a major application of the invention, it should be understood that the FIG. 1 embodiment and principles involved therein also have other important applications as will become apparent as this description progresses.

Detailed Description Text (2):
The channel follower and depth finder 10 has a conventional oscillator 14 having preferably a square wave 16 voltage signal output across a primary 18 of an isolation transformer 20 having a secondary 22 with one side electrically coupled by an electric cable 23 to a transmitter electrode 24 fixed to extend downwardly (FIG. 14) from the bottom of the boat at centerline 26 at the prow of the boat 12 and in electrical engagement with the water 13 supporting the boat. The other side of the isolation transformer secondary 22 is coupled through an electric cable 28 to a second electrode 30 preferably fixed to extend downwardly from the bottom of the boat 12 on the boat centerline 26 at the stern and in electrical engagement with the supporting water 13.

Detailed Description Text (9):
In the operation of the FIG. 1 channel follower, the moveable arms 66 and 78 of the selector switch 68 are moved downwardly to engage the channel follower switch poles 94 and 96 respectively for thereby completing the circuit from the channel follower receiver electrode 104 through line 100, selector switch pole 96, switch arm 78, line 76 to the variable gain amplifier 72; and also completing the circuit from the other channel follower receiver electrode 102, line 98, switch pole 94, switch arm 66, and electric cable 70 to the variable gain amplifier 72.

Detailed Description Text (10):
The oscillatory voltage signal 16 from the oscillator 14 appears through the isolation transformer 20 across the transmitter electrodes 24 and 30. In this

regard, it has been empirically found that the channel follower receiver electrode 102 or 104, which ever is the nearer to a shore bank or wall, will more nearly approach the potential of the nearer transmitting electrode which in the present instance is the transmitting electrode 30. The channel follower receiver electrodes 102 and 104, each approximate a potential between the potentials of the transmitting electrodes 24 and 30 given by linear geometry --analogous to a slide wire resistor --if the water 13 becomes so shallow as to be considered a thin film around the boat 12. However, if the water 13 about the boat 12 is very deep, the channel follower receiver electrodes 102 and 104 more nearly approach the midpotential between the transmitter electrodes 24 and 30, even though the channel follower receiver electrodes 102 and 104 are offset by the distance 106. This observed phenomenon which is herein referred to as the channel follower effect was experimentally verified and is represented qualitatively in the FIG. 2 graph. The curve 111 in FIG. 2 represents the potential of a single electrode such as 102 when placed on the centerline 26 and the boat is close to a channel wall or bank while the depth of the water is varied. Curve 113 represents the potential of the same electrode when the boat 12 is in open water on all sides and only the depth of the water is varied. It will be noted that these experimentally found curves show that two channel follower terminals such as 102 and 104, each located respectively on the port and starboard sides of the boat 12 will be different distances from a bank or wall near one side of the boat 12 and will thereby be at different potentials regardless of depth of water.

Detailed Description Text (11):
This potential difference of the channel follower receiver electrodes 102 and 104 is fed through the selector switch 68 and electric cables 70 and 76 to the variable gain amplifier 72 whose amplified output is fed to one side of the phase sensitive detector 108. It is there compared to the signal 16 also appearing through line 107 at the phase sensitive detector 108 and the averaged product of the compared signals is indicated on the dial of the voltmeter 112. For calibrating the dial of the voltmeter 112 for channel following, a conventional balancing adjustment is preferably made in the phase sensitive detector 108 to obtain a center or neutral reading with indicator hand 114 preferably pointing vertically when the boat 12 is in open water with no obstructions on any side or in the center of a deep channel with similar walls on each side of the boat 12.

Detailed Description Text (14):
Also, the calibration of the indicator 112 may be used for determining actual distance from one side or the other of a known channel because of the substantially linear change in voltage differential at the channel follower receiver electrodes 102 and 104 with distance to the nearer channel wall as shown by the FIG. 8 graph line 118 drawn through a plurality of points made under known channel conditions where the abscissa arrow mark represents the center of the channel.

Detailed Description Text (16):
In the operation of the FIG. 1 depth finder, the moveable arms 66 and 78 of the selector switch 68 are moved upwardly to electrically engage the depth finder switch poles 64 and 80 respectively as shown in FIG. 1. The oscillatory signal 16 from the oscillator 14 across the transmitter electrodes 24 and 30 effects a current through the transmitter electrodes 24 and 30 and water 13 surrounding the boat 12. The depth finder receiver electrodes 60 and 84 being offset a distance 86 and 88 respectively from the center point 90 between the transmitter electrodes 24 and 30 will always have a finite potential because of their offset positions. Voltage across the depth finder receiver electrodes 60 and 84 is found to be a function of the depth of water 13 under the boat 12 for a given current of the transmitter electrodes 24 and 30 and may be represented by the curve 119 in the graph of FIG. 9. Referring to FIG. 9, it will be noted that the portion 120 of the curve 119 is the response for deep water which represents no problem to navigation, whereas, the remainder of the curve 119 becomes increasingly linear and sensitive as the depth of water decreases and the need for knowledge as to depth increases.

Detailed Description Text (17):
For the purpose of providing a suitable reference or bridge balance for the potential across the depth finder receiver electrodes 60 and 84, a portion of the signal between the transmitter electrodes 24 and 30 is picked up by the receiver electrodes 32 and 34 for creating a potential across the voltage divider resistor 38 and potentiometer resistor 40. Thereby, adjustment of the potentiometer resistor wiper 54 permits the creation of a suitable balancing potential in the circuit comprised of depth finder receiver electrode 60, electric cable 58, balancing transformer secondary 56, electric cable 62, switch pole 64, switch arm 66 and electric cable 70 to the variable gain amplifier 72. It will be noted that the wiper arm 54 on the potentiometer resistor 40 makes possible a wide range of both positive and negative balancing potentials. Thus by suitable adjustment of the wiper 54 and gain control 74 of the amplifier 72, the indicator hand 114 may be set at full scale reading when the boat 12 is in deep water and the face of the indicator 112 marked for position of the indicator hand 114 for various known diminishing depths of water to that which is minimal for passage of the boat 12, such as for example indicated by the points 120, 122 and 124 on the curve 119 in FIG. 9.

Detailed Description Text (56):
The secondary 140 also being the same transformer core 319 will have induced therein the square wave oscillations from the Royer oscillator 298 and will cause them to appear across the transmitter electrodes 132 and 134 extending from the bottom of the boat 130. A resulting oscillatory signal will be picked up by the depth finder receiver electrodes 150 and 158. Also current through the resistor 142 will cause a balancing square wave signal through the transformer 144 and across the balancing potentiometer resistor 152. By suitably adjusting the potentiometer wiper 170 on the balancing resistor 152, the oscillatory signal picked up by the depth finder electrodes 150 and 158 may be balanced out as a suitable reference or null point for a given known depth condition such as when deep water at the practical limit of the instrument is known to exist under the boat 130. Under such null condition there will be no signal across the gain control potentiometer resistor 166 and thus no signal output in the output line 232 of the variable gain amplifier 178. The meter 278 may be set for a full scale reading of the indicator hand 280 such as at 322 for the above known null calibration condition.

Detailed Description Text (60):
Additionally an audio warning indication of approaching shallow water may be obtained by the use of earphones 230 or a loudspeaker or other suitable alarm at amplifier output line 232 where change in signal intensity may provide audio indication of change in water depth.

Detailed Description Text (68):
FIG. 11 illustrates a further embodiment which combines both a channel follower and a depth finder having capacity for giving simultaneous readings of depth and direction for best channel course. In FIG. 11 an oscillator 350 which may be similar to the oscillator 14 is coupled to apply an alternating voltage signal across a pair of transmitter electrodes 352 and 354 fixed to extend downwardly from the bottom of a boat 358 on longitudinal centerline 356 and in electrical engagement with the supporting water. The transmitter electrodes 352 and 354 may be similar to the electrodes 24 and 30 of FIG. 1. A pair of reference receiver electrodes 360 and 362, which may be similar to the receiver electrodes 32 and 34 of FIG. 1 and similarly placed, are electrically coupled through a potentiometer resistor 364 carrying an adjustable wiper 366 coupled to one end of a primary of a depth finder transformer 368, the other end of which is coupled to a centertap 370 of a primary of a channel follower transformer 372 is coupled The primary of the channel follower transformer 372 is coupled across a pair of combined channel follower and depth finder electrodes 374 and 376. The receiver electrodes 374 and 376 may be similar to the receiver electrodes 102 and 104 of FIG, 1 and placed a

distance 378 from a center point 380 which is preferably equal to one-fifth to one-tenth the distance between the electrodes 352 and 354. While the spacing 378 is shown forward of the center point 380 as distinguished from rearward spacing 116 in FIG, 1, such forward spacing 378 results in reversal of attitude sense to position sense signal polarity and is shown here to illustrate that such forward spacing is usable in the present invention when properly interpreted. The transverse spacing 382 between the electrodes 374 and 376 is also preferably equal to one-fifth to one-tenth the distance between the transmitter electrodes 352 and 354.

Detailed Description Text (72):
The FIG. 12 embodiment provides indication of an immersed obstruction such as a post, mine or other material body 392, as relative movement between it and a boat 394 or other vessel carrying the FIG. 12 embodiment occurs. In FIG. 12 an oscillator 396 such as the oscillator 14 is coupled to apply an alternating potential signal across transmitter electrodes 398 and 400. The transmitter electrodes 398 and 400 may be similar to the electrodes 24 and 30 of FIG, 1 and similarly placed on a centerline 402 and extending downwardly in electrical engagement with water supporting the boat 394. A pair of receiver electrodes 406 and 408 which may be similar to electrodes 102 and 104 of FIG, 1 are fixed to extend downwardly in engagement with the supporting water as in FIG, 1 except in that they are on a transverse line 410 midway between the transmitter electrodes 398 and 400. The receiver electrodes 406 and 408 are separated a distance 412 preferably equal to one-fifth to one-tenth the distance between the transmitter electrodes 398 and 400 and equidistant from the centerline 402. The receiver electrodes 406 and 408 are coupled to the input of an amplifier 414 which may be similar to the amplifier 72 of FIG. 1. The output of the amplifier 414 is coupled to an electric meter 416 which may be similar to the meter 112 of FIG, 1.

Detailed Description Text (73):
In the operation of the FIG, 12 embodiment, the meter 416 will display a voltage deflection such as illustrated by a curve 418 in FIG. 13 when the boat 394 passes an immersed obstruction or other material object 392. The vertical broken line 420 in FIG. 13 indicates the meter reading when the object 392 reaches the transverse centerline 410 in FIG. 12.

CLAIMS:

1. In an apparatus for sensing proximity of material obstructions in a fluid medium the combination of a pair of transmitter electrodes in spaced relation to each other in electrical engagement with the fluid medium, means for applying an electrical potential signal across said transmitter electrodes, at least one receiver electrode in electrical engagement with the fluid medium between and in spaced relation to the transmitter electrodes at a position along an imaginary line of symmetry through said transmitter electrodes closer to a center position between said transmitter electrodes than to either of said transmitter electrodes and spaced a substantial distance from said center position, carrier means rigidly fixing said electrodes in place for movement in said medium with said electrodes carried in the same relative positions with respect to each other, means coupled to said transmitter electrodes for deriving a reference potential, and electric signal measuring means coupled to the receiver electrode and reference means for measuring said signal at said receiver electrode with respect to said derived reference potential and including indicator means calibrated for sad signal measurement to indicate proximity of such obstruction beneath said electrodes.

4. The combination as in claim 3 wherein said measuring means includes a phase sensitive detector coupled for comparing said receiver electrode signal as appearing with respect to said reference potential to said oscillatory signal applied to the transmitter electrodes.

5. The combination as in claim 3 wherein a said reference means includes second

receiver electrode fixed to said carrier means in electrical engagement with the water in line with the transmitter electrodes and displaced from said center position between said transmitter electrodes by the same distance as said first mentioned receiver electrode and on the opposite side of said center position from that of said first mentioned receiver electrode, said receiver electrodes being separated by a distance equal to about one-tenth to one-fifth the distance between said transmitter electrodes, and said reference means is couplet to both said receiver electrodes.

7. In an apparatus for sensing proximity of material obstructions in a fluid medium the combination of a pair of transmitter electrodes in spaced relation to each other and in electrical engagement with the fluid medium, means for applying an oscillatory electric potential signal across said transmitter electrodes, at least one pair of receiver electrodes in electrical engagement with the fluid medium on an imaginary receiver electrode line in transverse relation to an imaginary line of symmetry through said transmitter electrodes and on respective sides of said line of symmetry, said receiver electrode line being substantially closer to one of said transmitter electrodes than the other of said transmitter electrodes, carrier means rigidly fixing said electrodes in place for movement in said medium with said electrodes carried in the same relative positions with respect to each other, means coupled for measuring the signal across said receiver electrodes and including an indicator calibrated for said signal measurement to indicate the side proximate to a laterally disposed obstruction.

8. The combination as in claim 7 wherein said receiver electrode line is displaced from a center position between said transmitter electrodes by a distance equal to between one-fifth and one-tenth said transmitter electrode spacing.

9. The combination as in claim 7 wherein said receiver electrodes are separated by a distance equal to about one-tenth to one-fifth the distance between said transmitter electrodes and said imaginary receiver electrode line is displaced from a midpoint between said transmitter electrodes by a distance equal to about one-tenth to one-fifth the distance between said transmitter electrodes.

10. The combination as in claim 7 wherein said signal means includes a square wave oscillator; and said measuring means includes an amplifier coupled to said receiver electrodes, a phase sensitive detector coupled to said amplifier and oscillator for comparing said receiver electrodes and oscillator signals, indicator means coupled to said phase sensitive detector and calibrated for neutral indication when said transmitter electrodes are aligned with and in the center of a channel and for indication on respective sides of said neutral indication when said transmitter electrodes are displaced toward respective sides of said channel.

11. The combination as in claim 9 wherein said signal means includes a square wave oscillator; and said measuring means includes an amplifier coupled to said receiver electrodes, a phase sensitive detector coupled to said amplifier and oscillator for comparing said receiver electrodes and oscillator signals, indicator means coupled to said phase sensitive detector and calibrated for neutral indication when said transmitter electrodes are aligned with and in the center of a channel and for indication on respective sides of said neutral indication when said transmitter electrodes are displaced toward respective sides of said channel.

13. In an apparatus for sensing material obstructions in a water medium the combination of a pair of transmitter electrodes in spaced relation to each other in electrical engagement with said medium; means for applying an oscillatory electrical potential signal across said transmitter electrodes; two receiver electrodes in line with said transmitter electrodes and in electrical engagement with said medium, each receiver electrode being displaced on a respective side form a center position between said transmitter electrodes with the distance between the receiver electrodes being between one-tenth and one-fifth said transmitter

electrode spacing; and electric signal measuring means coupled to said receiver electrodes for measuring the signal at said receiver electrodes, said measuring means including a signal balancing circuit coupled to said signal applying means and receiver electrodes for providing an electric bridge balance for said receiver electrode signal, a third pair of electrodes with each fixed close to a corresponding one of said transmitter electrodes, a voltage divider resistor and potentiometer resistor coupled in parallel across said last mentioned electrodes, a centertap on the voltage divider resistor, an adjustable wiper on the potentiometer resistor, and a balancing transformer having a primary coupled to said centertap and adjustable wiper, and a secondary coupled in series with one of said displaced receiver electrodes.

14. The combination as in claim 13 wherein said measuring circuit has additionally means for amplifying said bridge balanced receiver electrode signal, and a phase sensitive detector coupled to said amplifier means and transmitter electrode signal applying means for comparing said amplified signal and transmitter means signal.

15. The combination as in claim 14 having additionally a pair of receiver channel follower electrodes in spaced relation to each other transversly to and on respective sides of said in line electrodes and displaced from said center position by a distance equal to one-fifth to one-tenth of the spaced relation of said transmitter electrodes, and means for coupling said channel follower receiver electrodes to said signal measuring means.

16. The combination as in claim 15 including additionally a boat having a bottom substantially symmetrical on either side of a center axis and said electrodes are fixed to electrically engage said water at said bottom with said transmitter and in line electrodes being on said axis.

17. In an apparatus for sensing material obstructions in a water medium the combination of a pair of transmitter electrodes in spaced relation to each other in electrical engagement with said medium; means for applying an oscillatory electrical potential signal across said transmitter electrodes; two receiver electrodes in spaced relation to each other, equally distant from a center position between said transmitter electrodes, in transverse relation to said transmitter electrodes and displaced from said center position by a distance equal to between one-fifth and one-tenth said transmitter electrode spacing; and electric signal measuring means coupled to said receiver electrodes for measuring the signal at said receiver electrodes, said measuring means including a channel follower transformer with a primary coupled across said receiver electrodes, a centertap on said primary, a reference signal source, and a depth finder transformer having a primary coupled to said centertap and reference signal source, thereby effecting across said channel follower transformer electric signals having an intensity correlation to orientation of said transmitter electrodes in a channel and across said depth finder transformer electric signals having an intensity correlation to depth of said medium.

18. The method of sensing the presence and proximity of a material obstruction in a fluid medium comprising the steps of applying an oscillatory electric signal potential to the fluid medium across two spaced apart small area positions in said medium, measuring the resulting signal potential at a third small area position in the medium with respect of a fourth small area position under conditions of known material obstructions within the useful measuring range, the third position and fourth position being on an imaginary line transverse to an imaginary line of symmetry through said first mentioned positions and on respective sides of said line of symmetry and substantially closer to one of said first mentioned positions than to the other of the first mentioned positions, and indicating the amount of any change in the measured signal potential at the third position under conditions of unknown material obstructions in the fluid medium in terms of the side proximate to a laterally disposed obstruction.

20. The method of <u>sensing the presence and proximity</u> of material obstruction in a fluid medium comprising the steps of applying an oscillatory electric potential to the fluid medium across two spaced apart small area positions in said medium, measuring the resulting signal potential at a third small area position in the medium with respect to a fourth small area position under conditions of known material obstruction within the useful measuring range, the third and fourth positions being along an imaginary <u>line</u> of symmetry through the first and second positions and spaced a substantial distance from a center point between said first and second positions, and indicating the amount of any change in the measured signal potential at the third position with respect to said fourth position under unknown material obstruction in the fluid medium in terms of proximity to such obstruction beneath said positions.

22. In a ship mounted apparatus for <u>sensing proximity</u> of material underwater obstructions to movement of said ship through the water to facilitate guidance of said ship in manner to avoid contact with such obstructions, the combination of a pair of <u>transmitter</u> electrodes mounted on the hull of said ship in spaced relation to each other in electrical engagement with said water, means for applying an electrical potential <u>signal</u> across said <u>transmitter</u> electrodes, at least one receiver electrode mounted on the hull of said ship in electrical engagement with the water between and in spaced relation to the <u>transmitter</u> electrodes at a position which is on an <u>imaginary line</u> of symmetry through said <u>transmitter</u> electrodes and displaced from a center position between said <u>transmitter</u> electrodes by a substantial distance, means coupled to said <u>transmitter</u> electrodes for deriving a reference potential and electric <u>signal</u> measuring means coupled to said receiver electrode and reference means for measuring the <u>signal</u> at said receiver electrode with respect to said derived reference potential and including indicator means calibrated for said <u>signal</u> measurement to indicate proximity of such obstruction beneath said ship.

26. The combination as in claim 22 wherein said <u>signal</u> across said <u>transmitter</u> electrodes is an oscillatory <u>signal,</u> and said measuring means includes an amplifier coupled for amplifying said receiver electrode <u>signal</u> with respect to said reference potential, and a phase sensitive detector coupled for comparing said oscillatory <u>signal</u> to said amplified <u>signal</u> for improving the accuracy of said <u>signal</u> measurement on said indicator.

27. The combination as in claim 26 wherein said <u>transmitting</u> means includes a switching wave generator for effecting said oscillatory electrical potential <u>signal</u>.

28. In a ship mounted apparatus for <u>sensing direction and proximity</u> of massive underwater obstructions to movement of said ship through the water to facilitate guidance of said ship in manner to avoid contact with any of said obstructions, the combination of a pair of <u>transmitter</u> electrodes mounted fore and aft on the hull of said ship in spaced relation to each other in electrical engagement with said water, means for applying an electrical potential <u>signal</u> across said <u>transmitter</u> electrodes, a pair of receiver electrodes separate from said <u>transmitter</u> electrodes mounted in transverse relation to said <u>transmitter</u> electrodes on the hull of said ship in electrical engagement with the water and on respective sides of an <u>imaginary line</u> of symmetry through said <u>transmitter</u> electrodes, each of said receiver electrodes being substantially closer to one of said <u>transmitter</u> electrodes than the other of said <u>transmitter</u> electrodes and in spaced relation to the <u>transmitter</u> electrodes, and electric <u>signal</u> measuring means coupled to said receiver electrode pair for measuring the <u>signal</u> across said receiver electrodes, said measuring means including indicator means calibrated for indication of side and proximity of said ship to such massive barrier.

31. The combination as in claim 30 wherein said electric <u>signal</u> potential across

said transmitter electrodes is an oscillatory electrical signal potential, and said measuring means includes a differential amplifier coupled for amplifying the signal differential across said receiver electrode pair.

32. The combination as in claim 31 wherein said measuring means additionally includes a phase sensitive detector coupled for comparing said amplified signal from said amplifier and said oscillatory signal from said transmitter electrode applying means for improving accuracy of said receiver electrode signal measurement.

33. The combination as in claim 32 wherein said means for applying an electrical potential signal across said transmitter electrodes includes a switching wave generator for effecting said applied oscillatory electrical potential signal.

35. The combination as in claim 31 having additionally means coupled to said transmitter electrodes for providing a reference potential signal; and said measuring means includes means for obtaining a receiver electrical potential signal intermediate the signal potentials between said pair of receiver electrodes, means for measuring said intermediate signal with respect to said reference, and an indicator calibrated for said measurement to indicate depth of water beneath said ship.

36. The combination as in claim 28 wherein a second pair of receiver electrodes are mounted on said hull in electrical engagement with the water and in parallel relation to said transmitter electrodes, and said measuring means includes an indicator calibrated for signal measurements across said second receiver electrode pair to indicate proximity of such obstructions disposed below the level of said ship.

38. The combination as in claim 37 wherein said electric signal potential across said transmitter electrodes is an oscillatory electrical signal potential, and said measuring means has additionally means coupled to said transmitter and receiver electrodes for modifying the electrical signal potential across said receiver electrode pair to facilitate correlation of said receiver electrode signals for said indication of proximity of such obstructions.

39. The combination as in claim 38 having additionally another pair of receiver electrodes at the bottom of said hull in transverse relation to said transmitter electrodes and an indicator arranged for operation with said transverse electrodes and calibrated for causing the signal across said pair of transverse electrodes to indicate proximity of such obstruction in lateral relation to said ship.

42. The combination as in claim 41 wherein said hull is substantially symmetrical on each side of an imaginary centerline running longitudinally at the bottom of said hull, said transmitter electrodes are fixed to said hull in said forward and rearward positions for substantially symmetrical current conduction through said water on respective sides of said centerline when said water is free of obstructions, and said receiver electrodes are fixed to said hull below the water level on respective sides of said centerline.

46. In an apparatus for sensing material obstructions in a water medium the combination of a pair of transmitter electrodes in spaced relation to each other in electrical engagement with said water medium, means for applying an oscillatory electrical potential signal across said transmitter electrodes, at least one receiver electrode in electrical engagement with the water medium between and in line with the transmitter electrodes at a position which is displaced from a center position between said transmitter electrodes by a distance equal to between one fifth and one tenth said transmitter electrode spacing, carrier means rigidly fixing said electrodes in place for movement in said medium with said electrodes carried in the same relative positions with respect to each other, and electric

signal measuring means coupled to the receiver electrode for measuring said signal at said receiver electrode, said measuring means including a circuit coupled to said transmitter electrodes for providing an electric reference signal for measurement of said receiver electrode signal, said last mentioned circuit including a pair of receiver electrodes with each of said pair fixed close to a corresponding one of said transmitter electrodes for providing the coupling thereto.

47. In an apparatus for sensing material obstructions in a water medium the combination of a pair of transmitter electrodes in spaced relation to each other in electrical engagement with said water medium, means for applying an oscillatory electrical potential signal across said transmitter electrodes, a first receiver electrode in electrical engagement with the water medium between and in line with the transmitter electrodes at a position which is displaced from a center position between said transmitter electrodes, a second receiver electrode in electrical engagement with the water medium in line with the transmitter electrodes and displaced from said center position between said transmitter electrodes by the same distance as said first mentioned receiver electrode and on the opposite side of said center position from that of said first receiver electrode, said receiver electrodes being separated by a distance equal to about one tenth to one fifth the distance between said transmitter electrodes, and electric signal measuring means coupled to both said receiver electrodes, said measuring means including a signal balancing circuit coupled to said signal applying means and receiver electrodes for providing an electric bridge balance for said receiver electrode signal, said balancing circuit including a voltage divider resistor and potentiometer resistor, means coupling said voltage divider resistor and potentiometer resistor in parallel across said transmitter electrodes, a centertap on the voltage divider resistor, an adjustable wiper on the potentiometer resistor, a balancing transformer having a primary coupled to said centertap and adjustable wiper and a secondary coupled in series with one of said displaced receiver electrodes.

48. In a ship mounted apparatus for sensing massive underwater obstructions to movement of said ship through the water to facilitate guidance of said ship in manner to avoid contact with any of said obstructions, the combination of a pair of transmitter electrodes mounted in spaced relation to each other fore and aft of said ship along a centerline of the hull at the bottom of said ship and in electrical engagement with said water, means for applying an oscillatory electrical signal potential across said transmitter electrodes, a pair of receiver electrodes separate from said transmitter electrodes mounted on the hull of said ship in transverse relation to said transmitter electrodes on respective sides of said centerline, means coupled to said transmitter electrodes for providing a reference potential signal; and electric signal measuring means coupled to said receiver electrode pair for measuring the signal across said receiver electrodes, said measuring means including a differential amplifier coupled for amplifying the signal differential across said receiver electrode pair, an indicator calibrated for a center of channel indication for massive channel barriers symmetrically located on respective sides of said ship and corresponding off center channel indication as said ship is disposed nearer to a corresponding one of said channel barriers, means for obtaining a receiver electrical potential signal intermediate the signal potentials between said pair of receiver electrodes, means for measuring said intermediate signal with respect to said reference, and an indicator calibrated for said last mentioned measurement to indicate depth of water beneath said ship.

49. In a ship mounted apparatus for sensing massive underwater obstructions to movement of said ship through the water to facilitate guidance of said ship in manner to avoid contact with any of said obstructions, the combination of a pair of transmitter electrodes mounted in spaced relation to each other along a centerline of the hull at the bottom of said ship and in electrical engagement with said water, means for applying an oscillatory electrical signal potential across said

transmitter electrodes, a pair of receiver electrodes separate from said transmitter electrodes mounted at the bottom of said hull along said centerline in electrical engagement with the water and in spaced relation to said transmitter electrodes, and electric signal measuring means coupled to said receiver electrode pair for measuring the signal across said receiver electrodes, said measuring means including an indicator calibrated for said signal measurements across said receiver electrode pair to indicate proximity of such obstruction disposed below the level of said ship and means coupled to said transmitter and receiver electrodes for modifying the electrical signal potential from across said receiver electrode pair to facilitate correlation of said receiver electrode signals for said indication of proximity of such obstructions.

Previous Doc Next Doc Go to Doc#